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M. N. Baker. Editor

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Concerning the Need of Moisture in Furnace-Heated Houses.

Some comments regarding the need of adding moisture to the air of furnace-heated houses, included in the review of the excellent book by Mr. T. M. Clark, on "The Care of the House," published in the November number of this Supplement, have brought out two interesting letters, printed below under "Correspondence." Mr. Andrews dissents from the opinions expressed in our review, while Professor Chatburn aims rather to emphasize the need of more data on the subject. The latter also sends an interesting paper by Mr. Loveland, on moisture in offices and dwellings, which is reprinted elsewhere in this issue of Engineering News. Regarding that paper the only statement needed here is that Mr. Loveland's experiments strengthen what Mr. Andrews and others write as to the inadequacy of ordinary evaporating pans in hot-air furnaces.

For the double purpose of showing the general inadequacy of much that has been written on the subject in question and the lack of agreement among various writers, and of stimulating discussion and research, we have attempted to supplement Mr. Andrew's citations from Billings' "Principles of Ventilation and Heating," and the experiments of both Mr. Andrews and Mr. Loveland, by a review of some of the other literature bearing upon the subject.

For the sake of both convenience and clearness this review will be prefaced by a repetition of our quotation from Mr. Clark's book and also of our comments thereon. Mr. Clark said:

> . . . many physiologists now believe that a dry, warm air, if pure, and moderately heated, as is generally the case where it is supplied through modern furnaces, is more favorable to health in winter than an atmosphere which is warm and moist, and that people who live in houses where no attempt is made to supply artificial moisture to the air in winter are less likely to take cold than those who have the pores of the skin, while they are in the house, kept open by an atmosphere intentionally moistened. Experience seems to have confirmed this view, and very few modern furnaces have any provision for evaporating water in the air-chamber.

Of the foregoing statements we ventured to say, and it will be noticed that we wrote somewhat tentatively:

> Had the author stated that most evaporating pans are too small, and that large and small ones are too generally neglected to be of any material value in ameliorating the desert-like dryness of the furnace-heated house, we should not have been at all surprised, but we did not suppose that any physiologists of good standing had concluded that ample evaporation did more harm than good, nor that such omission of water pans as is now practiced, be it general or rare, was based on disinterested scientific opinion. The physiological objection to the dry air from furnaces, we had supposed, was largely based on the shock to the respiratory tract due to the sudden changes from the dry, hot air of the ordinary furnace-heated house to the relatively moist and cold air of outdoors, while there has seemed to be much force in the belief that such hot, dry furnace air was in itself injurious. We do not say that Mr. Clark may not be right, but we should like the names of some of the "many physiologists" upon whom his theory is partly based.

Referring now to Mr. Andrew's letter, our proposed review will be opened by saying that the book from which he makes citations has been superseded by "Ventilation and Heating" (New York, 1893), yet the chapter "On Moisture in Air, and its Relation to Ventilation," in the later book, is largely composed of abstracts and quotations from writings published prior to 1880, the latest date mentioned being 1888; but since Dr. Billings wrote in his preface (January, 1893) that the later book was "substantially a new book," it may be assumed that on the date named he saw no reason to change his earlier opinions. It seems only fair, however, to call attention to the dates named, and to the possibility of the need of revising opinions printed ten years ago and based so largely on writings dating more than thirty years back. We take pleasure in adding, however, that Dr. Billings' book contains the most extended discussion of this subject which we have found in any book, and that the discussion as a whole is valuable and suggestive.

Turning to a more recent work, namely, Prof. Rolla C. Carpenter's "Heating and Ventilation" (New York, 1st ed., 1895, 4th ed., 1902), we find no such extended discussion of the subject in question as in Billings. Instead, there is a paragraph of a page or so on "Air Humidity," which opens as follows:

> The moisture contained in outside air in winter weather is small. When such air is warmed to 70° without increasing the moisture which it contains, the capacity of the warm air for absorbing additional moisture is large, and evaporation from all moist surfaces becomes rapid. The skin and mucous membranes of the mouth, throat, and nose, and the moist surfaces of the eye and ear, are more or less affected, in some persons with irritating and even serious results. Except for such consequences, dry air is hygienically advantageous, because of its effect in retarding the development and reducing the vitality of microbes, and also because it retards the decomposition and decay of organic matter.

Instead of telling the reader what, if anything, can be done to alleviate the irritation caused by low relative humidity, Professor Carpenter proceeds with evidence against the "irrational position assumed by humidity hobbyists" who advocate "an out-of-door June humidity" for school rooms; but elsewhere in writing on hot-air furnaces he says an evaporating pan is "added to every furnace," and that this is important "since the heated air requires more moisture than cold to maintain a comfortable degree of saturation."

In Louis Parkes and Henry Kenwood's Hygiene and Public Health (Philadelphia, 6th ed., 1901), it is asserted that "it is upon relative humidity that health and comfort depend."

What constitutes the "comfortable degree of saturation" mentioned in the first, or what is the proper "relative humidity" named in the second of the last two preceding quotations?

One of the latest utterances on this point is found in Ellen H. Richards and Alpheus G. Woodman's "Air, Water and Food" (New York, 1900), as follows: "A relative humidity of 60% is said to be the most comfortable for house temperature." Other writers than those cited place proper relative humidity all the way from 50 or 55% (see the next quotation) to as high as 70%.

Reverting to the general subject under discussion, perhaps the most satisfactory exposition of it from one who believes in the need of adding moisture, is that given by Prof. Charles Harrington, M. D., Assistant Professor of Hygiene in the Harvard Medical School, in his "Manual of Practical Hygiene" (Philadelphia, 2d ed., 1902). After speaking of the difference of opinion on the subject he says:

> The weight of evidence from a medical standpoint and from our own sensations points to the advisability of introducing an amount of moisture sufficient to bring the relative humidity of the air to 50 or 55%. . . . A volume of air at 0° F., containing its fullest possible amount of aqueous vapor, admitted to the cold-air box of a furnace and then heated to 85° F., before being conducted to the rooms of a house, will have at its new temperature but a very small relative humidity. It will be so much drier than any outside air, that that of the driest climate in the world will be moist in comparison. . . . When outside air is heated so as to maintain an even temperature of 70° F., but with no addition of water vapor, its capacity for absorbing moisture is very much increased, and it will take it up from all moist objects with which it comes in contact. It will take it from the skin, from the mucous membranes of the mouth, nose, and respiratory tract; from furniture made from wood which, in the process of kiln-drying, was never brought to such dryness; from the leather binding of books, causing them to crack and fall to pieces; and from plants, which, in consequence, wither and die. It thus causes more or less dryness of the skin, irritation of the throat, and coughs. It causes also need of a higher temperature, to give the same sensation of warmth and comfort, than is the case with air containing a normal amount of moisture.

The author then states, and on this nearly every one seems to be agreed, that even when furnace evaporating pans are kept full, "which is not often, they are very inadequate for their purpose." After describing how a Boston physician maintains his office at a relative humidity of 53% by means of cotton wicking communicating with a reservoir of water, the wicking being suspended in or over the warm-air registers, he next describes an extensive evaporating apparatus connected with the mechanical ventilating system of the building of the American Bell Telephone Co., in Boston, and quotes Mr. C. J. H. Woodbury, under whose direction the plant was installed, as follows:

> . . . another feature indicating the greater comfort of the building was the absence in winter of the coughing by those employed there, a cough of the bronchial kind or from the larynx, a cough which ends with a squeal, which is so prevalent in New England during the winter; especially in those employed in offices.

If we are not mistaken, the building occupied by the Bell telephone interests in New York is also provided with means for supplying moisture to the air. It may be added that one reason for such a provision in buildings which house telephone exchanges is to protect the throats of the operators from the excessive dryness, irritation and strain which would be caused if the air was deficient in moisture.

Presumably references to the publications of the American Society of Heating and Ventilating Engineers and of the American Public Health Association would enable us to extend this citation of opinions from engineers, sanitarians and hygienists, but perhaps enough space has been devoted to the subject already; and certainly a sufficient variety of opinions has been cited to show the lack of unanimity in the books on heat-

ing and ventilation. All seem to agree, however, in the belief that the ordinary evaporating pan is too small and too much neglected to afford any considerable amount of moisture to furnace-heated air. There is also a general agreement to the effect that the relative humidity of furnace-heated houses is low. Most of the writers admit, directly or indirectly, that such relatively dry air may cause irritation of the throat and possibly of the eyes, while some are decidedly of that opinion and also believe that good hygiene demands a remedy. Most of those who argue that such relatively dry air is harmless, if not advantageous, seem to base their opinion largely on the healthfulness of out-door life in very dry climates, where the conditions are fairly uniform for weeks, and in some cases for months, at a time; whereas the relative humidity of furnace-heated houses often varies widely from day to day and sharp contrasts are presented when one goes from the outer to the inner air, or the reverse.

Finally, we agree with our Nebraska correspondent that here is an opportunity for more extended physical and physiological, and perhaps psychycological, observations.

CORRESPONDENCE.

Some Further Criticisms of Technical Books.

Sir: I fully agree with what "Engineer" has to say in your issue of Nov. 12 regarding many books and their failing on examination to prove complete in their treatment of subjects, or what their titles state they are, or what the practicing engineer desires, which facts he generally finds out after he has bought the book.

Living, as I do, a considerable distance from large cities, I have to purchase many books through advertisements and reviews and often find I am simply out of pocket the price of the book, with practically nothing in return.

Take the subject of surveying, in which a great number of us, in the West, in general practice, are largely interested. As a rule, I may say, there are too many books on surveying, and hardly any of value. J. B. Johnson's "Theory and Practice of Surveying" is good, and largely used for reference. The others all class about the same, from the old Gillespie to the new Nugent.

This last I bought on the strength of the review published in your Supplement,* and on its advertisement. The review spoke of "the very complete article on mining surveying" by Prof. Wm. S. Hall. The advertisement called the book "a text and reference book for students in engineering and for the use of engineers generally." This last is practically the title. Both statements are misleading to the prospective buyer, if an engineer.

The article on mining surveying treats of definitions; difficulties are enumerated (a very few); the ordinary uses of top and side telescopes and the tape as preliminaries. All these the practicing engineer knows. The three-tripod system is dismissed in 23 lines. One method, only, is given for marking stations, which method works well in a coal or slate roof.

Traversing underground consumes three pages; this refers to entry or gangway work only. Mapping only treats of the entry and rooms or stalls and the section work. In fact, Professor Hall says on p. 336 "Mining engineers have different methods for instrumental work and recording notes. Details will be given of one of the most approved methods."

As to the article on mine surveying being complete as your review mentioned, thus far I would merely say that no mention is made of different kinds of spuds; of surveys in mines run on the long-wall system; of what is known in the West as the Union Pacific Method; of surface marks above various underground portions of the mine, or how best to place them, whether in squares or triangles; of room sights or of room measurements; of entry grading; of plotting on the pitch; surveys in steep slopes when the pitch changes; of method of locating and planning a survey for a new coal mine from the original base line and triangulation to the entry lines; of the advantages and disadvantages of the full-circle azimuth bearings (which is often the best method); and of how to show on the map, the stations, direction of air, brattices, sumps, etc., etc. The method given by Professor Hall is a sketch, merely, of the one in use in the anthracite regions of Pennsylvania. Why did he not say so?

It is true that Professor Hall mentions the calculations of ore reserves, 18 lines, which includes also the calculations of coal beds. Nothing is said of stopes or stope books or long sections. No mention is made of connecting the surface with the underground workings, by means of the ordinary telescope of the transit when the pitch is steep, which method might often help an engineer in a pinch. U. S. mining claims is disposed of in three pages; Johnson takes twenty and leaves out much. In short, the part of the book which I have just reviewed is neither complete nor of "use to the engineer" generally.

Turning now to the book as a whole: The first 323 pp. contain very little that is new or of use to the practicing engineer. It is true that from p. 100 to p. 152 various tests, more physics than enginering, are given, and a few more are scattered through the book. The theory of these tests is given, which is good for the student. The "a" is the book is not what it purports to be in its title, nor is the article on mining surveys complete, as the review stated. It is a book for students and no more.* I have gone into this in some detail because it happens to be the last book I purchased.

A few others I have whose titles are misnomers, as "Water Supply Engineering; the Designing, Construction and Maintenance of Water Supply Systems, both City and Irrigation," by Prof. A. P. Folwell. It is a book for students. Compare it with Fanning and for the practicing engineer it fails. It is too general and lacks details. Compared to Fanning, it is like Wheeler's "Civil Engineering" compared to Rankine's.

H. M. Wilson's "Irrigation Engineering" affords another illustration, though on the whole it has some good information in it.† Its main fault is that it purports to be a "Manual of Irrigation Engineering," and is made up largely of historical reviews of large irrigation works. It gives too little detail. It would not help the irrigation engineer very much should he be actually constructing a canal, a weir, a dam or other irrigation work.

"Astronomy for Engineers" is another misnomer.‡ The details are insufficient on what the author terms "rough and approximate determinations." He might have omitted "precise determinations" without harming the book. Ordinary engineers in general practice would be satisfied with the first two. Those who make precise determinations need another and fuller treatise. It is neither one thing nor the other; it is not detailed enough for the engineer in its simple determinations, nor full enough for the man on geodetic work in its precise determinations.

I have mentioned a few works; there are others.

May there not be some remedy for these difficulties? We surely cannot force authors to name their books as we desire, therefore could we not begin at the other end? I think if some large firm dealing in engineering books would make the following or a similar proposition to engineers it would help. Let the engineer either give satisfactory references or else deposit, say, $10, with this firm to insure it against loss; then let the firm agree to ship to the engineer, on approval, any work whose cost does not exceed $8, the engineer to pay postage both ways in case he does not buy the book and also be responsible for any damage. By this means the firm would be secure, and if the books were good, the sales would be larger than now. It is quite true, if the books were not what they purported to be the sales would be less; but engineers at a distance would be able to see more books than they do at present and on the whole would buy more than they do now. Uinta.

Evanston, Wyo., Nov. 25, 1903.

(We are glad to have such searching and practical criticism as that contained in the above letter, and also in the letter by "Engineer" printed in the last issue of this Supplement. These letters are proof (if any were needed) that we were justified in making the statement, in our October issue, that public criticism of books by their engineering readers is needed for the improvement of technical books.

The above letter may also serve to support the statement made in our last issue that "opinions on what should be included in a book may differ widely, often with equal plausibility in favor of each side." Fifteen different engineers, if asked to outline a book on a given subject, might present fifteen radically different schedules of contents. And it might be that if fifteen books were written to suit closely these different opinions, our review would have to be highly appreciative in every single case; and yet that fourteen of the engineers in question would severely criticise and condemn as unsatisfactory the book written to the specification of the fifteenth.

It is desirable that engineers should appreciate what varying wants there are for books in any given definite field. Letters reach this office constantly asking for books to suit most specialized requirements. One writer asks for "an elementary book on analytical geometry and differential and integral calculus combined." Another wants a book on the design of pony-truss highway bridges. Others again ask for something teaching completely the design of bridges and structural steel work, something which a beginner can study through, the book not to cost over $2.50. And the list might be continued at length. Even "easier" requirements than the preceding are often hard to meet.

These remarks are not intended to weaken the force of our correspondent's criticisms. We venture only to make the supplementary suggestion that if Professor Nugent's book were written throughout in as much detail as our correspondent suggests for a particular portion, it would be a ponderous volume. And we may further note that discussion is possible on many of the points criticised by "Uinta;" for example, the practicalness of Professor Comstock's book, a work which we had occasion to review appreciably some months ago. We are certain, however, that our readers' comments on books will be found of more value than our own opinions, provided it be borne in mind that these comments represent generally an individual special manner of view.

In this connection we would repeat what we said a month ago, and what the above letter also implies:

> . . . . books should in most cases be written primarily, not for the student but for the practicing engineer. . . . When there is no need for a book on a given engineering subject, except for the use of college instruction, then there is no need for its existence.

As to the final suggestions of our correspondent, the Engineering News is willing to send to any of its readers in the United States or Canada any American technical book, charges prepaid, on receipt of the list price thereof, with the understanding that if the book is not satisfactory to the purchaser, and he will return it in good condition, the amount paid for the book, less return charges (when not prepaid) will be refunded or credited to his account. The return charges may be considered as a fee for the privilege of examining the book, or as a division of the cost of that privilege, since the outgoing charges are prepaid.—Ed.)

Moist Air in Houses as Discussed in "The Care of the House."

Sir: In your review of Mr. T. M. Clark's book on the "Care of the House," in the Engineering Literature Supplement of Nov. 12, you take exception to his remarks regarding the beneficial effects of dry air in houses.

Dr. John S. Billings, in his treatise on "The Principles of Ventilation and Heating" (2d ed., New York, 1886), has a good deal to say upon the subject of moistening the furnace heated air. He says:

> The precise influence which either the absolute or the relative amount of moisture in air has upon health is uncertain. . . . Simple dryness of the air certainly is not injurious to health. . . . When we turn to artificial climates, we find that in our houses in winter, with the external air at 32° F., the percentage of moisture is often between 30 and 40° without producing any discomfort.

Dr. Billings goes on to quote Dr. Cowles, from the Report of the Massachusetts State Board of Health for 1879, regarding the dry air of the Boston City Hospital:

> I believe that no discomfort has been felt or ill effects produced from the low relative humidity, even on the occasions when there was only 15% to 21% of saturation. Certainly, in this ward there is uniformly observed a remarkable absence of complaint of any kind that can be ascribed to the condition of the air, and a peculiar feeling of its freshness and purity is frequently spoken of by those who enter the room.

Dr. Billings seems to regard the complaints from dryness as in reality due to other causes and he speaks of the difficulty of materially increasing the percentage of moisture in the air of the artificially heated house and of "the condensation which would occur on windows and thin outer walls."

A number of years ago, the writer made some experiments in a small house heated by means of a hot air furnace. Even by doubling the evaporating area of water near the furnace it was found difficult to increase the amount of moisture more than a few per cent., and no sensible difference was observed when the furnace had been quite dry for several days. The capacity of air for moisture, as deduced from tables given by Guyot, is about as follows:

Aqueous Vapor in 1,000 Cu. Ft. of Saturated Air at Different Temperatures in Degrees Fahrenheit.

Degs.	Lbs.	Degs.	Lbs.	Degs.	Lbs.	Degs.	Lbs.
0	0.08	30	0.28	60	0.82	90	2.12
10	0.12	40	0.41	70	1.14	100	2.83
20	0.19	50	0.56	80	1.56		

It is very evident from this table that air taken into a

*The book in question, Prof. Paul C. Nugent's "Plane Surveying," was reviewed before the Supplement was started, in Engineering News for May 8, 1902.—Ed.

*The preface to the book indicates as much.—Ed.

†A new edition of this work is reviewed elsewhere in this issue.—Ed.

‡The book which we presume our correspondent has in mind is Prof. Geo. C. Comstock's "Text-Book of Field Astronomy for Engineers," reviewed in this Supplement for Feb. 19, 1903.—Ed.

house in winter must be extremely dry; in heating by steam or hot water no attempt is made to increase the moisture of the air, yet we do not often hear complaints of undue dryness in the air of steam or hot water heated houses. The hot air furnace is in general the only one in which an attempt is made to supply moisture, and yet it is precisely with this that the complaints due to dryness arise. Dr. Billings's explanations of the real sources of the annoyance, wrongly ascribed to dryness, seem very plausible.

The writer has evaporated as much as 15 lbs. of water in eight hours in a large steam-heated room of 17,000 cu. ft. capacity, with a relative humidity of 52.4% at the beginning of the experiment and 51.8% at its ending. The external temperature ranged from + 8° to + 21° F.

In general a very low temperature externally will result in very dry air within the house, notwithstanding effects to increase the moisture, while a moist day, with temperature above 32° F. outside, will do more to moisten the moisture of the internal air than any artificial evaporation.

Let your reviewer maintain an unvitiated and not overheated atmosphere in his house and he will have no complaints to make of its "desert-like dryness."

Very truly yours,

Horace Andrews, M. Am. Soc. C. E.

51 State St., Albany, N. Y.

(A discussion of some of the points raised in this and the following letter, together with a partial review of the literature of the subject, will be found in the preceding columns of this Supplement.—Ed.)

Some Nebraska Observations on Moist Air in Dwellings and Offices.

Sir: In your criticism of the "Care of the House" in the Supplement for Nov. 12, you made some remarks relative to the sizes of evaporating pans in house furnaces. I was reminded thereby of a paper I heard Mr. G. A. Loveland, Section Director of the U. S. Weather Bureau, Lincoln, Neb., read at a meeting of the Nebraska Academy of Sciences. I have secured a copy of said paper which I hereby forward to you.

Mr. Loveland tells me that he is unable to learn of any investigations which have been carried to a definite conclusion as to the effect of dry air upon health, or the ability to do work. Here seems to be a field for the experimental psychologist, if not also the physiologist. Mr. Loveland's experience has led him to believe the extremely dry atmosphere to be injurious, and he has added to his own furnace a large evaporating pan, almost if not quite touching the combustion chamber. There seems also to be less of the sensation of chilliness at moderate tempertures (65° to 70°) if the air is not too dry.

Yours very truly,

Geo. R. Chatburn, Asst. Prof. Civil Engineering.

University of Nebraska, Lincoln, Neb., Nov. 24, 1903.

(The interesting paper sent by our correspondent is reprinted in full elsewhere in this number of Engineering News. The general subject is discussed at some length in this Supplement, as stated in the note to the letter from Mr. Andrews, just above.—Ed.)

Rules for Curve Compensation in Webb's Railroad Construction.

Sir: Webb's revised edition of Railroad Construction (reviewed in your Supplement for April 16, 1903) has, on p. 458, six rules for curve compensation, as follows:

(1) On the upper side of a stopping-place for the heaviest trains compensate 0.10% per degree of curve.
(2) On the lower side of such a stopping-place do not compensate at all.
(3) Ordinarily compensate about 0.05% per degree of curve.
(4) Reduce this rate to 0.04% or even 0.03% per degree of curve if the grade on tangents must be increased to reach the required summit.
(5) Reduce the rate somewhat for curvature above 8 or 10°.
(6) Curves on minor grades need not be compensated.

The writer is willing to accept unmodified, for the use of his classes, only two of the rules, Nos. 1 and 5, and Rule No. 3 should be modified considerably. The desk copy of the writer has a line drawn in red ink across each one of the rules of even number.

As to Rule 3: This will answer in its present form for a trunk line with light curves. The writer can cite an instance where long coal trains, climbing a long ascent on which curves of 8° and under are compensated at 0.035%, gain speed on the curves.

As to Rule 4: There is not very much actual elevation lost in curve compensation, no matter whether the rate 0.03% or 0.05% is used. A recent case in point: A 1% grade 2½ miles long climbed an ascent in about as rough mountain country as most engineers are called on to work in. Curves up to 10° were used. The rate of compensation was 0.04% for 4° curves and under, 0.35% for curves between 4 and 7°, and 0.03% for curves of from 7 to 10°. The elevation surrendered for compensation in the 2½ miles was 11.6 ft. The short summit cut was 67 ft. deep and the long fill at the foot of the grade was 31 ft. high. The rate of compensation used was fixed in an effort to make the resistance up the grade uniform. The writer would like to be informed how this compensation could be adjusted under Rule 4 to materially alter the cost of the work without surrendering the object for which the compensation is introduced. However, Rule 4 is more reasonable than either Rule 2 or 6.

As to Rule 2: The writer has in mind an eight-mile 1% grade climbing up to a summit where there is a station at which all freight trains stop. Thirteen hundred feet below the summit there are 60° of 10° curve. If this curve had been left uncompensated how many of the heavy coal trains toiling up the grade loaded for the 53-ft. grade could have gotten into the siding?

As to Rule 6: There is always the possibility that with a growing traffic the maximum grades may be reduced or operated with a helper, and then the heaviest, or prevailing, minor grade becomes the ruling grade. There is a division on one of the Western roads which when constructed had in one direction one long 1.35% grade, uncompensated, with 4° curves, and one 1.2% grade (nearly) with 5° curves. The remainder of the division was located on 1% grades over 4° curves uncompensated. The 1.2% grade has been reduced to 1%, and the 1.35% is now operated with a helper. The ruling grade is now very close to 1.2°, whereas if the prevailing minor grades had been compensated in the first place the number of loaded cars per train could have been from two to three greater than can now be pulled.

W. D. Taylor, M. Am. Soc. C. E.,

Professor of Railway Engineering, University of Wisconsin, Madison, Wis., Nov. 27, 1903.

A Dictionary of Mechanical Drawing Wanted.

Sir: In an article entitled "Mechanical Drawing in a Modern Drafting Room," in your issue of Oct. 15 (main sheet), Mr. George H. Follows gives a description of a "drawing dictionary" in use in the drafting room of the Westinghouse Electric & Manufacturing Co., and points out how much more practical the training in mechanical drawing, given in college courses, might be made if a standard dictionary of drawing could be adopted.

The adoption of such a dictionary would be particularly welcome to those engaged in teaching mechanical drawing, and any step leading in the direction of more uniformity in the "language of engineering" would surely be beneficial to the profession of engineering at large.

Can not some of your readers suggest some method by which such a drawing dictionary could become a standard for draftsmen throughout the country?

Yours truly, R. E. Chandler,

Professor of Mechanical Engineering.

Oklahoma Agricultural and Mechanical College, Stillwater, Okla., Oct. 22, 1903.

(Our correspondent is one of many who have shown deep interest in the paper, as may be seen by reading the following note which we have received from Mr. Follows:

The favorable attention that my paper, "Mechanical Drawing in the Modern Drafting Room," has attracted has been a most agreeable surprise to me. Up to date I have received 37 letters referring to it, most of them asking how to obtain copies of different portions of Westinghouse Standard Data, and particularly the Drawing Dictionary. These letters have come from universities, colleges, technical schools, manufacturers, and private individuals from all parts of this country and even from England and Holland. All this makes it look as if there were a real demand for a "drawing dictionary."

We should certainly welcome, as doubtless would many others, suggestions of a practicable acter on this subject. The problem is twofold; (1) How to make a dictionary suitable for use in all drafting rooms, and (2) how to secure its general adoption after it is made. Of the desirability of drafting-room reform, in the way of accuracy, clearness, uniformity and, what is becoming more and more important, economy, there can be no question. Co-operation will be an essential to improvement, and this co-operation must be (1) among the technical schools, (2) among the various engineers and manufacturers employing draftsmen, and (3) between (1) and (2), or the teachers and the employers of draftsmen, respectively. We should be glad to hear from instructors and all others interested, including the draftsmen themselves, from whom, if from any quarter, a large part of the desired reform will eventually come.—Ed.)

How to Place Vertical Titles on the Backs of Books and Pamphlets.

Sir: Would it not be well for publishers to agree upon a uniform practice in placing titles on the backs of thin books, where the titles of necessity must read vertically? Out of 50 thin books examined at random in a small engineering library, the titles on 32 read from the bottom upward and on 18 from the top downward. In view of the fact that a map or a plan is lettered so as to read from the right and bottom [i. e., the position of the reader] it seems that the title on the back of a book, if vertical, should also read from the right, that is, from the bottom upward. The writer suggests as an interesting experiment that 20 thin books, half of the titles reading from the bottom upward and half from the top downward, be placed in alternate order upon one shelf; and that 20 other thin books with their titles all reading in one direction be placed upon another shelf. The time required to read the 20 titles in each case can be noted and a comparison made. Is there any reason why vertical titles on books and pamphlets in general should not read from the bottom upward? Yours truly,

William T. Lyle,

5247 Larchwood Ave., Philadelphia, Pa., Nov. 28, 1903.

(We fully agree with our correspondent in his claim that vertical lettering on the backs of books should be uniformly in one direction, and that the proper direction is from the bottom upwards. In a shelf full of books lettered some one way, some the other, either the books lettered from the top downwards must be paced bottom down on the shelf or the person reading the titles must read some titles upside down, or else, to avoid the latter he must shift his position from the right to the left of the book. The only justification, if it can be called such, for lettering the backs from the top downwards is that when a book is lying flat on a table or desk, title page and cover upwards, the back title is then bottom side up when lettered as our correspondent suggests and we prefer. But the normal place for any considerable number of books, and particularly technical books, is on book-shelves, where they naturally stand upright.

The point at issue may seem a small one to some, but it will be appreciated by all who have much to do with the classification of books on shelves or reference to them when in that position.—Ed.)

Another Railroad Field-Book With Tables for Laying Out Curves on the Arc of the Circle.

Sir: There are published so many field-books for railroad engineers that one can hardly expect to become familiar with all of them. The writer, however, has always found much interest in a comparative study of such books, and therefore when he read in the review of Mr. Haynes' book on "Railroad Curves" (Literature Supplement, Engineering News of Oct. 15) that it "differs from all others on the subject in that the tables are designed to be used in laying out curves measured on the arc of the circle and not along the chord," he immediately thought of that in many ways most excellent book by the late Professor Philbrick ("Field Manual for Engineers," P. H. Philbrick, 1901), in which the system of measurement along the arc is advocated. Professor Philbrick does not recommend the use of a different chain length for every curve, however, but is satisfied to use chains of 100, 50 and 25 ft., as the case may require, remarking that:

When the chord is made the standard of measurement the sum of the lengths of sub-chords exceeds more and more the length of the chord the shorter they are; whereas when the arc is made the standard of measurement the sum of the lengths of the sub-chords falls short of the lengths of the arc less and less the shorter they are.

Professor Philbrick's Table I. gives "Degrees" and "Radii" of curves, and "Chords for One Station;" and Table III.B gives "Chords for Arcs of 100 Feet." In both of these tables the chord given is the same that Mr. Haynes would use in laying out his curves. Furthermore, the other tables given in Professor Philbrick's book are based on the use of the unit arc.

A rather interesting discussion of this subject may be found in this same work by Professor Philbrick, pp. 42-46.

E. G. R.

Columbus, O., Nov. 20, 1903.

Electrical Books in Spanish.

Sir: Kindly advise me if you know of any publications in Spanish on electrical subjects. O. T. Youngman.

128 Jefferson Ave., Brooklyn, N. Y.

(Perhaps some of our readers can name some books that will meet the need of our correspondent.—Ed.)

An American Book on the Gas Engine.

Reviewed by Prof. Storm Bull,* M. Am. Soc. M. E.

THE GAS ENGINE.—A Treatise on the Internal Combustion Engine Using Gas, Gasolene, Kerosene, or Other Hydrocarbon as a Source of Energy. By Frederick Remsen Hutton, Professor of Mechanical Engineering in Columbia University. New York: John Wiley & Sons. London: Chapman & Hall. Cloth; 6 × 9 ins.; pp. 483; tables and 243 illustrations in the text. $5.

The American literature on the subject of the gas engine has been very unsatisfactory to this date. With the greatly increased interest in this line of mechanical engineering during the last few years the lack of suitable or adequate books on this branch has been more and more felt by everybody who has been working even only occasionally in this direction, and consequently this new book by Professor Hutton will be welcomed by many of our mechanical engineers, treating, as it does, to a certain extent, at least, of the modern and American form of the gas engine. Heretofore the only treatises in the English language on this subject of any consequence had been written in England, and had treated it from an English point of view, which, as everybody knows, in a great many lines, is very different from our own. This state of affairs was presumably due to the fact that the gas engine had been greatly neglected by both our engineers and manufacturers. This new book is therefore also a sign of the very evident fact that although still behind our European competitors in this line, we are now trying to make up for lost time.

The author in his preface states that the reason why this book has not appeared before was that until now there has been but very little American practice to be studied, and the reader has therefore the right to expect that this book should treat of this American practice; not to the exclusion of European practice, but at least in an exhaustive manner. In this direction the book is disappointing, as comparatively little of the distinctively American practice is shown. So far as the knowledge of the reviewer goes, no fundamental innovations in the design or cycle of the gas engine, brought out during the last few years, can be credited to American engineers, and the distinctively American practice would therefore have to be shown in the details of American-built gas engines. This is not done in Professor Hutton's book. In fact, in his preface he states that

> no attempt has been made to enter upon the field of the design of the gas engine considered as a machine. The field of engine design has been so admirably covered by others with respect to the steam engine and the same principles of design apply so readily to the gas engine, with the necessary modifications introduced by differences in principle, that this subject has been discarded in the present treatment,

and as a consequence we find but very few drawings or cuts of American engines, and these of a very general nature, without any dimensions, so that the book will be of comparatively small value to the gas-engine designer.

The reason why Professor Hutton does not treat of the gas engine as a machine, seems entirely wrong to the reviewer, and for two reasons: First of all, the design of a gas engine is a very different thing from that of an ordinary steam engine using saturated steam, principally because of the high temperatures met with in the gas engine, or because of "the necessary modifications introduced by difference in principle," as stated by Professor Hutton in his preface. Anybody looking through the recent German book on the gas engine by Güldner (reviewed by Professor Bull in this Supplement for May 14.—Ed.) will at once be struck by the radical difference in design between the modern gas engine and the ordinary steam engine. But in the second place, the reviewer is not aware of the fact, as announced in the preface, that the design of the steam engine "has been so admirably covered by others." Perhaps because of ignorance, the reviewer does not know of any American book in this line which would answer the description given above. There are, to be sure, several books on steam engine design which are very useful, but as a teacher of steam engine design the reviewer has always felt and still feels the want of an adequate book on the subject. As a consequence, the American engineering profession will still feel very strongly the want of a book in which it can find the very necessary and useful information in regard to the "design of the gas engine considered as a machine."

The criticism of the book so far has been made on what has been omitted and not on what it contains. Coming now to the book itself it may be stated that, so far as it goes, it is quite satisfactory. It is divided into twenty chapters of which necessarily some are much more important than others. In the second chapter the author treats of "Liberation of Heat Energy and Combustion." The question of combustion in general is first taken up, including a fairly full discussion of the products of combustion, after which the calorific value of the various fuels, with a description of the usual instruments for determining the same, is considered. The chapter also contains descriptions of the various kinds of fuels, together with analyses thereof. It is rather surprising to find under the heading "Blast-furnace Gas" an illustration of an engine for utilizing this gas, no other engine being described or illustrated in this chapter. One could have wished that the author had given somewhat more space to producer-gas and to the apparatus in which it is generated, as only a very few of the modern types of gas producers are given. It seems also rather peculiar that Professor Hutton should classify the Dawson and Lencauchez producers with the water-gas producers, which classification certainly is against the common usage of the terms. All these producers, whether of the one or the other kind, use steam in the manufacture of the gas, which, however, in the case of a water gas producer, is not well adapted for the use of a gas engine, but which, as Professor Hutton truly states, is very well suited for this purpose, when it comes from an ordinary producer like the Dawson, Lencauchez, Taylor or Mond, which fact shows that the gas produced is of different nature in the two cases.

In Chapter III. the author gives a condensed thermodynamics of gases. The question will inevitably be raised whether such a subject should find place in a book on the gas engine, when it is remembered that thermodynamics in general ought to be studied before a book like this one is taken up. However, in this chapter is also found a discussion of the specific heat of the products of combustion, a subject which certainly belongs here, which is of great importance, and which is very satisfactorily treated.

The next chapter has for its title "The Heat-Engine cycle." Under the head of "The Cycle of the Steam Engine" the author states that

> with the perfect gases the range of possible methods of heating, expanding and cooling becomes greatly enlarged since the manner of heating, the method of expansion, and the ultimate disposition of the gas after the work done by the expanding gas and the properties of the medium itself are without significance. This peculiarity was first presented by Carnot, who first called attention to the existence of the cyclic action.

At another place in the same chapter it is stated that "the Carnot cycle and the equation for its condition of maximum efficiency do not necessarily apply to the internal combustion engine by reason of the fact that the gas engine does not operate necessarily under the conditions of the Carnot cycle." To the reviewer these statements are far from clear. The author is evidently speaking of theoretical conditions under which alone Carnot's cycle can be supposed to exist, as at another place he states that the cycle of Carnot may serve as a type for all cyclic action with a permanent gas. Why not for saturated steam? And why does not the Carnot cycle stand in the same theoretical relation to the cycle of the steam engine as to that of the gas engine? It would seem that the author in this chapter has confused the theoretical cycle of an engine with the actual one. When he states that the maximum efficiency (that of the gas engine) may be, and usually is dependent on other conditions (than those of the Carnot cycle) of which the formula must take account, then he has evidently reference to the actual cycles, as found in the gas engine, but this has nothing to do with the fact that the Carnot cycle gives the theoretically highest efficiency for any heat engine, whether it be a gas or steam engine. In the same article the author enumerates a long number of possible cycles, not as they can be carried out in reality, but by combining all kinds of thermal curves into cycles, which possible combinations evidently in the opinion of the author are the reasons why the Carnot cycle does not apply to the gas engine. The reviewer must confess that he cannot see the logic of this, and he can still less see any good reason for working out all these impossible cycles,a few of which only are approached in practice, the large majority of which, however, are purely mental experiments.

In the same chapter are also found enumerated not less than 24 advantages of the gas engine, as compared with the steam engine, a number of which, however, seem to be quite imaginary; for instance the following one: "The fuel does not require a diluting excess of air for combustion, which lowers the temperature of the latter." The contrary is true: For the best economy of the gas engine an excess of air is needed, just as for the steam boiler.

The chapter on gas engines burning gas, using kerosene oil, using gasoline, and on alcohol engines, are very interesting, although as stated at the beginning, a larger number of illustrations of a more detailed character would have been desirable. It would also seem that the engines utilizing blast-furnace gas deserved a more extended treatment than accorded, as well as some of the other modern German engines, several of which are now being built in this country. Incidentally, it may also be mentioned that Professor Hutton includes the two-stroke cycle engines under the Otto cycle engines. This is directly against common and universal usage, and there does not seem to be any good reason for doing it.

The chapters on carburation and carbureters, on ignition and governing are the best of the book. The treatment is quite clear and exhaustive and is well illustrated.

In the opening sentence of Chapter XIII., on the cooling of the cylinder, the author apparently lays himself open to an accusation of believing that the cooling of the cylinder by means of the water jacket is beneficient with respect to the economy of the gas engine. That this is only an appearance and not the actual belief is evident enough from other statements; but the wording of the text at this place is very unfortunate.

The chapter on "Manipulation of Gas Engines" contains a good deal of useful information, and the same may be said of the chapter on the "Performance of Gas Engines by Test," both of which chapters are fully up to the best practice of today.

The longest chapter of the book is the seventeenth, which contains 133 pages, and which treats of the theoretical analysis of the gas engine. Twenty-six different cycles are here treated separately and quite exhaustively. Professor Hutton is quite correct when he states in his preface that "so far as known, this part of the work is the most complete treatment which has yet been made." On theoretical grounds these analyses may be very interesting, but to the engineer and designer, or to one who simply wants to gain information regarding our modern gas engines, three-fourths of these cycles are absolutely useless, and to the reviewer it would seem that the book would have been very much improved if some eighty or more of these pages had been used to illustrate the design of the modern gas engine instead of being used to work out the formulas for cycles which are absolutely impossible in practice.

Chapter XVIII. gives a separate treatment of engines with heating at constant pressure. Professor Hutton is of the opinion that this type has a great future before it, although he evidently does not admire the Diesel engine very much, which is evident from the fact that he speaks of the inconveniently high compression of this engine as something to be avoided in the future type.

The chapter on tests on explosive mixtures is very satisfactory and contains information which otherwise would have to be gathered from a great many sources.

The historical summary is, in the reviewer's opinion, somewhat too short—only two pages. In the older books on the gas engine the historical part occupied too much space, but it seems that

*Professor of Steam Engineering, University of Wisconsin, Madison, Wis.

Professor Hutton has gone to the other extreme.

The bibliography concluding the book will be found very useful, although it is not complete by any means. It is unfortunate that the name of the "Zeitschrift des Vereins Deutscher Ingenieure" should be changed to "Zeitschrift fur Deutscher Ingenieure," as it appears in the bibliography.

In a good many ways this book is better than any of the older ones in the English language on the same subject, and it will no doubt find a very wide circulation. Precisely because of the many good things in it it is to be regretted that the whole book is not up to the same standard.

An Engineer on the Engineer in So.th Africa.

THE ENGINEER IN SOUTH AFRICA.—A Review of the Industrial Situation in South Africa After the War and a Forecast of the Possibilities of the Country. By Stafford Ransome, M. Inst. C. E., Special Commissioner of "The Engineer" in South Africa. New York: E. P. Dutton & Co. Cloth; 6 × 9 ins.; pp. 320; plates, folding map and figures in the text. $2.50 net.

The book before us is a review of engineering and industrial conditions and opportunities in South Africa, and is the outcome of nearly a year's study on the part of the author, who, at the close of the Boer War, was appointed by "The Engineer" to report upon conditions in all the British possessions there.

Every manufacturer of machinery for the African trade will do well to read this treatise with care, for it is full of useful hints; and any engineer, mining or civil, who contemplates going to Africa will find in these pages a great deal of valuable advice. He will learn, for example, that the seemingly high salaries are relatively not high when the cost of living is considered. The author says:

> A man and his wife could live in a small house and mix socially with the rest of the world in a modest manner for from $400 to $600 a month, according to locality. His house would be a galvanized shanty with five or six rooms, and he would keep no horses.

Speaking of the cost of traveling there, the author puts the cost at $525 a month, 10% of the time being spent in actual traveling. To "do" South Africa at all thoroughly, as the traveling representative of an engineering firm, will take seven months. The hotels are uniformly bad, and with equal uniformity high-priced—$5 a day being the regular rate. A young engineer seeking employment might spend a few months at a cost of about $1,000 after arrival. The author advises such a man to go to Cape Town rather than to Johannesburg at first, as every thing is congested in the latter place, due to want of black labor.

Speaking further of the black labor, the author says:

> We have put a stop to the inter-tribal warfare, and now that the natives have lost that means of thinning out the population, they are increasing in numbers with great rapidity throughout the country.

He speaks of the blacks as being more efficient than white men as common laborers, but doubts their ability ever to become skilled laborers. The labor question is treated at length, and the conclusion reached that the best system yet devised for handling the blacks is the "Compound" system used at the diamond mines. Despite its resemblance to temporary slavery the author maintains that it is better for the laborers themselves, protecting them in reality from their own ignorance and lack of foresight. It is even recommended that the Kaffirs be forced to work when they show no inclination to do so.

> As compared with the white man, the Kaffir is a child. We keep our children within bounds until they understand the world. It is our duty to do the same for the Kaffir.

This kind of talk about "duty," we see, crops out in a book on engineering matters as readily as in a political speech, whenever the handling of any of the dark-skinned races is mentioned by an Anglo-Saxon writer. The error in our author's syllogysm lies in his use of the little word "our"—"our children," is admissible; "our" Kaffirs, is another thing, quite. It may be, and doubtless is best for the white man to handle the Kaffirs like children; but there is little call for using the hypocritical word "duty."

Passing from "duty" of men to duty of engines, our author tells us that "American locomotives have been tried and found wanting," and are purchased only when no others can be had within reasonable time. We also learn that hardly any American flour-machinery is to be found in Cape Colony—and one feels like adding, so much the worse for the Cape. But what is more startling than either of these assertions is the one that follows:

> The proportion of American or other foreign machine tools used in engineering works here is not so large as it is in Great Britain itself to-day.

The author gives some excellent advice to manufacturers in the matter of catalogues. He says:

> And again I hear the oft-repeated complaint that I have listened to in China, Japan, India, Australia, South America and elsewhere, as to the insufficiency of the information contained in catalogues, worst of all the absence of prices. . . . . "If you look through that bookshelf," said a machinery agent to me last week, pointing to a long row of catalogues, "I will engage to say that you will not find price-lists in one out of six of the English books."

The author goes on to urge the desirability of price listing every article catalogued. Then he follows with some good advice as to the selection of a traveling salesman:

> It is technical advice that the users of machinery in South Africa requires. The flashy "drummer" with the diamond pin and a flow of generalizing twaddle is no longer of any value as a salesman of machinery. The purchaser at the present day knows too much. What is the use of sending a man of that stamp to talk to the engineers of a railway or a mine. The people he goes to see know more of the practical details of the machinery he is urging them to adopt than he does. Let a firm send out the very best technical man they can lay hands on, and let them pay him well.

The author finds the Boers so bitter in their feelings toward the Germans that in consequence German farm tools are not bought to the extent they they were before the war. American plows and other farm tools appear to have the hold on Boer affections at present.

There are interesting chapters on Business Policy for Manufacturers, Theory and Practice of Railways, the Harbors of Cape Colony, Diamond Mining in Kimberley, Underground at the Rand Mines, and the Treatment of Gold Ore. In the last-named chapter the author discovers the Robins belt conveyor, and says of it:

> I carefully examined a belt on the Robinson Deep Mine, which had been working for several months, and had lifted, I am told, 80,000 tons. I failed to detect as much as a scratch on its surface. The virtues of India rubber are truly wonderful.

The author briefly describes the Robins conveyor and predicts that belt conveyors will very largely supplant trucks and the like.

As stated in our opening sentences, this is a very useful book, full of excellent hints and suggestions. It is written, as will be evident from the quotations, in a popular style, but is none the less useful as a guide to manufacturers and engineers interested in South African matters.

The Most Recent British Work on Sewage Disposal.

THE PURIFICATION OF SEWAGE AND WATER. — By W. J. Dibdin, F. I. C., F. C. S., formerly Chemist and Superintending Gas Examiner to the London County Council and the late Metropolitan Board of Works, from 1882 to 1897. Third Edition, Revised and Enlarged. London: The Sanitary Publishing Co. New York: D. Van Nostrand Co. Cloth; 6 × 9 ins.; pp. 379; many tables,27 plates and 16 figures in the text. $6.50.

Those who are attempting to keep posted on the subject of sewage disposal, and particularly on the chemical and bacterial principles involved, will find this book of great value. It does not go into details of design and construction, but the author's own experience at London, Sutton and elsewhere is given in some detail, and opinions based on that experience and on an intimate knowledge of most of the important work done by others in England, and by some investigators in the United States, are also presented.

For the benefit of any who possess the first edition, it may be stated that the author has added much new matter, relating, among other things, to further experiments and practical operation of disposal works at London and Sutton, to the septic tank in England and the United States, and to the extended studies and reports on sewage treatment at Manchester and Leeds. Those who possess the earlier edition of the author's book, and also the London, Manchester and Leeds reports, and the American reports on the septic tank by Messrs. Kinnicutt and Eddy, will still find the present edition valuable for its presentation of some of those reports in a more compact form, and more particularly for the latest conclusions of this eminent investigator.

The first three chapters of the present edition contain a concise and interesting review of the history and principles of sewage treatment and of bacterial action in relation thereto. Chemical precipitation is shown to be, or we might almost say to have been, opposed to bacterial action, and attempts to make a profit are properly characterized as a great stumbling block to progress.

There follow five chapters on the experimental work already mentioned, with a chapter on "Land Treatment vs. Bacteria Beds," sandwiched in between two of the five. The early Massachusetts experiments are regarded as valuable in the way of suggestion rather than result, since they "still left the question in an all but impracticable form, as the quautity of sewage treated was so small." The author favors small septic tanks, if any are used, but evidently believes contact or other beds can be made to take the place of septic tanks, with less trouble from sludge, which last cannot be entirely got rid of by any system of treatment yet devised.

Factory refuse is given a chapter, and is considered amenable to bacterial treatment. There is a chapter of two pages, accompanied by a plate, on sewage screening.

"The Purification of the Thames" is the title of a chapter devoted largely to an historical description of London sewage disposal for some fifty years, and closing with this sentence:

> I candidly confess that I look forward to the adoption of the coke-breeze system, which I worked out at Barking Creek—as described in Chapter IV.—as the coping stone of my life's work in effecting the purification of the Thames.

After a short chapter on discharging crude sewage into the sea, which the author seems to disapprove unqualifiedly as "corrupting" the "bathing resorts and food supplies" of cities, the author takes up water filtration by the slow-sand method, the need for systematic examinations of water, the character of the water supplied to London, the action of water on lead, and various phases of water and sewage analysis.

A chapter on "Ventilation and Deodorization of Sewers" seems much out of place in this book, but the author considers its inclusion quite essential. The chapter, however, contains an interesting review of the subject, with some liberal extracts from special reports.

The body of the book concludes with some abstracts of the various reports of the Royal Commission on Sewage Disposal. There is an appendix on "Examination for Matters in Suspension." in which a micro-filter is described, and another on "Dissolved Oxygen." Each appendix is illustrated.

It may have been noticed that we have said nothing about the sections on water purification and more or less allied topics, except to mention them. These sections seem decidedly inferior to the part of the book devoted to sewage and its treatment, and the American reader, at least, would not miss them greatly. The discussion of water filtration is too brief to be complete, and we doubt if many, even of his own countrymen, will agree with the author in his belief that slow-sand filtration is bacterially so unreliable that it needs to be supplemented by some other method, and particularly by Clark's water-softening process. But so small a portion of the book is occupied by water purification that little need be said about it one way or the other, except to warn possible purchasers not to expect much on the subject.

The issue of the "Western Miner and Financier" (Denver, Col.; 15 cts.) for Oct. 15, 1903, is devoted wholly to cement and its various uses in concrete and concrete-steel construction. A wide range of subjects are covered, largely by reprints and abstracts of articles from other journals, including the Engineering News. A number of well-presented illustrations are included.

The New Epoch and the Engineer.

THE NEW EPOCH, AS DEVELOPED BY THE MANUFACTURE OF POWER.—By Geo. S. Morison. Boston and New York: Houghton, Mifflin & Co. Cloth; 5 x 7 ins.; pp. 134; portrait frontispiece. 75 cts. net.

This book is an inspiring study in certain broad phases of human evolution. It is stated in the preface that the late Mr. Morison was a classmate of John Fiske, and that the present volume was suggested by the elaboration of "the series of ethnical periods among prehistoric men," found in Fiske's "The Discovery of America."

As many of our readers will remember, Mr. Morison chose as a subject for his presidential address before the American Society of Civil Engineers in 1895 "The New Epoch and the Engineer." In 1896 he delivered an oration on "The New Epoch and the University" before the Phi Beta Kappa society at Cambridge, Mass., while in 1897 he delivered a commencement address on "The Civil Engineer and the University" before the Rensselaer Polytechnic Institute, at Troy, N. Y. About this time an article on "The New Epoch and the Currency" was contributed by Mr. Morison to the "North American Review." These four reviews of different phases of the manufacture of power in its relation to various human activities and influences were soon remodeled somewhat, and after being supplemented by a consideration of a few other phases of the general subject, the whole was ready for publication in April, 1898; but, we are told in a special prefatory note, "several causes," including "a natural modesty that made the author hesitate to offer to the public a work which was outside the field of his usual professional writings," prevented further steps towards publication until after Mr. Morison's death, on July 1, 1903. Perhaps this diffidence would not have been shown if only engineers ventured more freely into the fields of economics and general literature. Be that as it may, we trust that curiosity, if no worthier motive, will prompt many engineers to learn for themselves just what an engineer may achieve outside the beaten paths of his professional work.

Since the whole volume may be read in an hour or so, it seems almost a pity to attempt here to convey any further information regarding the contents of the book, but to increase the interest which we hope has already been aroused, such an attempt will be made.

In one of his opening pages Mr. Morison, in sketching the development of man and of industry, says:

> Fire, animal strength, and written language have in turn advanced men and nations; something like a new capacity was developed with the discovery of explosives and again in the invention of printing; but the capacity of man has always been limited to his own individual strength and that of the men and animals which he could control. His capacity is no longer so limited; man has now learned *to manufacture power*, and with the manufacture of power a new epoch began. . . . The manufacture of power means that *wherever needed* we can now produce practically unlimited power; whatever the measure of a single machine, that machine can be used to make a greater one; we are no longer limited by animal units, confined by locations of waterfalls, nor angered by the uncertain power of the wind.

And further on we are told that "the manufacture of power has an intellectual as well as a physical effect; it has separated power from the mind which must manage it." It is to the intellectual effect of the manufacture of power that the author chiefly addresses himself; and in doing so he shows a breadth and depth of mind that may well arouse and inspire the dullest and the narrowest of us. Thus, after reviewing the far-reaching, revolutionary effects of the new epoch on business, Mr. Morison wrote:

> In the race we are now in the midst of, which the manufacture of power is opening, new influences, new appliances, new powers, and new forms of education appear every day; only by constant effort, constant intercourse, continual study, and vigorous achievements can any country use the talents which are now before it. If the Americans are to make the best use of their America, they must call to their aid the work which the brains of Europe, and before long those of Asia, will contribute to the general benefit of mankind.

The chapter on "Business" is succeeded by one on "Capital," and this centers largely on the intelligent use of tools, using that word in a broad sense, and the employment of large amounts of capital under wise direction. Profits can no longer, or not for much longer, depend on secrecy, either among traders or manufacturers, for:

> The profits of the new epoch must be made not by buying cheap and selling dear, but by reducing the cost of production. . . . Permanent success will depend not on commercial drummers, but on the civil engineer; not on the shrewd guesses of the so-called business man, but on the accurate knowledge of the manager who knows what his tools are, who knows what it costs to produce, who knows the defects of his plant and the features in which it may be improved, who in fact is applying all the intelligence of an educated mind, not to getting the better of some other man who may know a little less, but to getting the best work possible for himself and his employers out of what he has to work with.

The chapter on "Government" opens with the declaration that "in the new epoch there must be a great increase in the variety of the duties of government." Many of the changes already effected are outlined, and it is asserted that:

> If a single government could be organized to handle the affairs of the entire earth and give equal rights and like laws to all races and conditions of men, the physical difficulties in enforcing the acts of government would be much less than those of handling the thirteen States at the time of the adoption of our Constitution.

The foregoing brief outline, with illustrative quotations, may perhaps serve to show how in the first part of the book the author presents some of the actualities and possibilities of the new epoch as developed by the manufacture of power; the succeeding chapters are designed to show how the responsibilities of the past have been met and the far greater ones of the future must be met, if at all, by the engineer. These three chapters deal with civil engineering, the university and education generally. For the engineer they are, or may be, the most instructive and helpful of any in the book, for in large measure the engineer already appreciates the significance of the manufacture of power, but there are relatively few engineers who have that broad conception here shown by Mr. Morison of the dignity and the mission of the engineering profession, and of the relation to it and to human progress held by technical education, and particularly by that liberal education that develops the man who is broader than any single profession.

A large part of the chapter on "Civil Engineering" is devoted to a definition of that term broad enough to cover the author's conception of it, which, as finally expressed is:

> Civil Engineering includes all branches of engineering, but not all engineers. It should include every engineer who applies a knowledge of the powers of nature to the design and construction of engineering works.

We are well aware that many will take exception to the exclusive and at the same time inclusive sense in which Mr. Morison uses the terms civil engineer and civil engineering, but although we think the usage is certainly open to discussion, the principle involved, if not the terminology adopted, is both correct and important, so we will pass on to the author's elucidation of the principle:

> . . . the education of the engineer will become more necessary, more thorough, and more exact than that of any other professional man. . . . This knowledge he must have, or he must be classed as a workman rather than a professional man. . . . The civil engineer of the new epoch must sink the individual in the profession. . . . Though the civil engineer must be a specialist, his specialty must not be of a narrow kind; he must have that general knowledge and training which makes the liberally educated man.
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> . . . . . .
>
> The civil engineer of the new epoch must fill many positions which are now held by men of different training. . . . Corporations, both public and private, must be handled as if they were machines and the men who will so handle them will find their best training in the education which will make the best civil engineers. These managers may not be called civil engineers, but civil engineering should not find fault with titles; the man whose training has fitted him to do the work of a civil engineer will not cease to be one if he is promoted to a high position of management.
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> . . . . . .
>
> He [the civil engineer] is the priest of material development, of the work which enables men to enjoy the fruits of the great sources of power in nature, and of the power of mind over matter. He is the priest of the new epoch, a priest without superstitions. But if this profession is to do the good work of which it is capable, the true spirit of individual immolation which has characterized the devoted priest of all ages must be found among its members. The profession can only do its future work by trained minds working together.

The chapters on "The University" and on "Education," besides the broader aspects indicated by their titles, contain many noteworthy ideas on the education of engineers and the relations of the latter to each other and to other classes of men. The university must not train men merely because they "wish to be scholars, but because scholars are necessary for the good of the community." The best work results "when professional knowledge so permeates the whole body of workers that each member has the benefit of what all are doing."

Mr. Morison claimed for civil engineering a rank among the liberal professions, but if this is to be achieved then the education of civil engineers

> must be broad enough for its disciples to understand and respect other lines of life; it must make it a profession whose members will hold their own among other educated men, a profession which will have its proper share of writers and original thinkers, a profession through which men may rise to do the most influential work, and to take the highest places of trust and honor in the land.

As to whether the engineer should take a general college course before entering the technical school the author says:

> If the professional school of engineering can dispense with the previous training of the college, it means that the engineer needs less general education than members of other professions do; it would almost seem to mean that civil engineering is not a liberal profession.
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> The real question, however, is not the value of the college course to any individual engineer, but the value of this preliminary education to the profession as a whole. . . . . The omission of the college course, thereby bringing the professional school of engineering immediately after the secondary schools, is right, if all engineers are to confine themselves to the strict limits of their work, if all engineers will be satisfied to be employed rather than to be employers, if engineers are to live by themselves, and measure the value of life by what they alone do.

That civil engineers should not so confine themselves, in Mr. Morison's opinion, those who really knew the man need not be told; and to any who wish to take the broader professional view, and particularly to the younger engineers who may not yet know which view they do or should hold, we heartily commend this book; a book which though small in bulk is large in thought and purpose.

Electric Wiring.

ELECTRIC WIRING.—A Primer for the Use of Wiremen and Students. By W. C. Clinton, B. Sc. New York: E. P. Dutton & Co. Flexible cloth; 5 x 7 ins.; pp. 179; tables and 80 illustrations in the text. 60 cts. net.

The purpose of this book is to teach the principles and a little of the practice of wiring up house lighting and bell installations. With due regard to this purpose and to the class of readers for which the book is intended, a large number of numerical examples is given in connection with the explanatory matter; all the examples, moreover, are worked out, so that the student can check his results both as to method of working and as to numerical answer.

About two-thirds of the book deals with wiring for lamp circuits. The author introduces the subject, after mentioning the three principal manifestations of electricity, by explaining Ohm's law and applying it to the calculation of wire sizes. Series and parallel circuits are adequately considered. Coming then to the more concrete parts of the subject, he describes wire insulation, methods of making joints in wire circuits, and systems of installation, i. e., on cleats, in casings, in steel tube, etc.; this also leads to the description of fittings, such as switches and fuses, rosettes and distribution boards. In connection with lamp fittings, the author takes occasion to sketch the construction of both incandescent and arc lamps. The final chapter of this part of the book describes the common methods of arranging the lighting circuits in houses.

Mr. Clinton's discussion of bell wiring is confined to a single chapter. This describes the action of electromagnets and their application to bell-ringing, both direct and with intermediate relay; the Lechanché cell is described, three or four different bell and indicator circuits are sketched, and

some remarks are given on the points of difference between bell wiring and light wiring.

An additional chapter contains descriptions of the construction and use of the wireman's detector, the Wheatsone bridge and the ohmmeter.

As may be gathered from the small size of the book, it is in no sense a treatise on wiring and installation. It cannot make a beginner an experienced wireman, but it can start him well along in his trade.

Locomotive Breakdowns and Their Remedies.

LOCOMOTIVE BREAKDOWNS, EMERGENCIES AND THEIR REMEDIES.—By Geo. L. Fowler, M. E. New York: The Norman W. Henley Publishing Co. Cloth; 5 x 7 ins.; pp. 244; 95 figures in the text. $1.50.

This book is written in the catechism style which has been adopted for several books intended for the use of practical machinists and enginemen. This style has certain advantages in presenting definite answers to direct questions, such as might be asked by men in actual charge of machinery. The range of accidents and defects, with their remedies, includes the various parts and fixtures, frames, boilers, valves, tenders, etc., etc., with a chapter on such miscellaneous emergencies as derailments and towing dead engines. There is also a special chapter on accidents to compound locomotives, while another chapter describes a number of tools and appliances for making repairs in the shops. Air-brake defects are given but a few pages, for the reason that there is already on the market a complete "Air-Brake Catechism," by Mr. R. H. Blackall, a new edition of which is reviewed in this Supplement. Finally, there is a chapter on first aid to the injured.

The book commences with a general warning to enginemen, as to protecting their trains by flagging in case of a breakdown, and advises them to become thoroughly familiar with the details of the engines which they run, as all engines possess certain features or peculiarities which will necessitate variations from the general instructions given. The necessity of cleanliness of engine parts when under inspection is also shown, since incipient cracks in connecting and coupling rods, for instance, may readily be detected if the rods are wiped clean, but would, of course, be invisible otherwise.

The book is printed in large, clear type, and the illustrations are clear and distinct.

While the book is written especially for the use of locomotive enginemen and firemen, it seems to us that it would be a good plan to put such a work in the hands of the engineering student, to show him the difference between practice and theory, and also to show him how the engine fails in service, and how the man treats the failures when they occur far from help and tools.

The Testing of Road Materials.

THE TESTING OF ROAD MATERIALS.—Including the Methods Used and the Results Obtained in the Road Material Laboratory, in Collaboration with the Office of Public Road Inquiries. By Logan Waller Page, Chief of the Road Material Laboratory, with the Co-operation of Alberton S. Cushman, Chemist of the Road Material Laboratory. Washington, D. C.: Bureau of Chemistry, U. S. Department of Agriculture. Paper; 6 x 9 ins.; pp. 77; 5 plates and 10 figures in the text.

This interesting bulletin should be in the hands of every engineer interested in road construction. The methods of testing the physical properties of road materials are clearly set forth, and are accompanied by illustrations of the rattlers and other mechanical devices for testing paving materials.

Among the testing machines described is the Darry machine for testing the abrasive resistance or "hardness" of materials. As there are reasons for believing that the wear of pavements is largely due to the abrasive action of dust between the wagon wheels and the pavement, it is not unlikely that in the future the abrasive test will be quite as important as the rattler test—if, in fact, not more important. This we believe will be found to be particularly true of block pavements, such as brick, where the impact of horses' calks is not so effective as such impact is upon macadam. The wear upon good macadam has in some instances in France been found to increase almost as the square of the traffic. Only one hypothesis accounts for this phenomenon (at least we have heard of no other rational explanation), and that is that the dust created by the grinding of other dust under each wagon wheel acts like so much emery under every wheel that follows. If this hypothesis is a true one, it follows that the Darry abrasive test is one that will come more and more into favor.

In the appendix to this bulletin there is a table giving the names of the tested rocks from different states and the results of tests showing coefficients of wear in the rattler, weight per cu. ft., percentage of water absorbed and cementing value. This table is followed by another table giving the chemical analyses of 230 rock specimens.

The authors of this bulletin are to be congratulated upon the thorough manner in which they have entered this interesting field of scientific investigation; and, it is not saying too much to add, the results of their future experiments will be looked forward to with eagerness by all engineers interested in the economics of roadwork.

A Liberal View of Engineering Education.

REPORT UPON ENGINEERING EDUCATION.—Prepared with reference to a proposed School of Engineering at the University of Chicago. By Elmer L. Corthell, C. E., D.Sc. Reprinted from the Technology Quarterly, Volume XVI., No. 3, September, 1903. New York: The Author, 1 Nassau St. Paper; 7 x 10 ins.; pp. 59.

This essay can be read to especial advantage in connection with "The New Epoch," by the late Geo. S. Morison, a review of which appears in another column of this issue. Mr. Corthell, like Mr. Morison, is a thorough believer in the impregnable position of civil engineering as an educated profession, and in the need of the very highest educational training to fit men for this profession. The community of thought of the two men is strikingly illustrated by the following quotation from Mr. Corthell's essay:

> It may be stated broadly that the civil engineer of the twentieth century must be an educated man and specially prepared for his life work by the highest order of educational instruction and training. But it has not always been so; steam and electricity, the potent forces of the present time, have been developed in little more than half a century. They, more than any other cause, have produced the civil engineer and raised him to rank with the older learned professions.

Starting with this premise that the engineer of the future must be an educated man, Mr. Corthell proceeds to outline the educational training required to develop men with such qualifications, and from the facts before him concludes that the first and fundamental requisite in the ideal education of young engineers is a broad, liberal education in philosophy and arts, precedent to the purely professional training. Space does not permit us to enter at length here into the reasons which the author gives for his conclusion. These, we trust, many of our readers will wish to examine at first hand by securing and reading the little pamphlet in which they are published.

In addition to its presentation of the claims made in behalf of a liberal education for engineers, the pamphlet summarizes the courses of training given to engineering students in the leading technical schools of Ireland, Scotland, England, France, Spain, Belgium, Switzerland, Germany, Italy and Russia. This digest of the educational methods practiced by foreign countries in training engineers is quite as interesting as any portion of the book. The author purposely refrains from drawing comparisons with American schools and methods, and we shall not attempt to supply the omission here. It may be noted, however, that in almost all the foreign schools mentioned a fairly high preliminary training in philosophy and arts is considered a necessary starting point for the special engineering training which they give.

While not affecting the main argument, it may be added that this report was written in 1898. In a supplemental note the author states that further observations strengthen his belief in the necessity for the establishment of such an engineering college as he has recommended in the report, and that "it is the duty and high privilege of the University of Chicago to establish this school."

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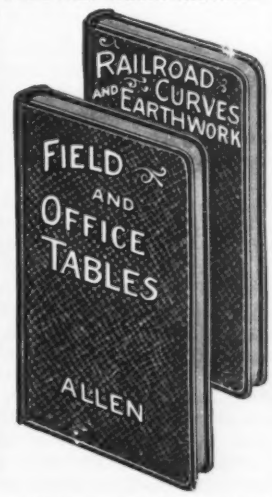

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A Popular Book on Modern Locomotion.

TUBE, TRAIN, TRAM, AND CAR.—Or Up-to-Date Locomotion. By Arthur H. Beavan; with an Introduction by Llewellyn Preece, M. Inst. E. E. London: Geo. Routledge & Sons. New York: E. P. Dutton & Co. Cloth; 6 x 9 ins.; pp. 291; one plate and 35 figures in the text. $2.50 net.

This is a book of the so-called popular class, written in daily newspaper style and language, with much padding in the shape of irrelevant matter, and with a sprinkling of technical information, which is sometimes pretty close to misinformation. The author evidently shares the popular opinion that electricity is to supersede all other power, and seems to think that the application of electrical power is extremely simple as compared with complicated steam engines and apparatus. To quote his own statement as to electric traction: "The system is beautifully simple, and the machinery compact and uncomplicated." The book treats almost entirely of English practice, including the several London underground railways, street and interurban railways, and horseless carriages and wagons. The author predicts electric power for navigation and describes in detail the saloons and accommodations of an electric liner, 1,600 ft. long, making the trip from London to Cape Town in 16 days. The machinery is "simplicity itself," with three propellers driven by "enormous" motors with "resistless" force. The current is presumed to be supplied from storage batteries, but as to the power required and the space occupied the author is discreetly silent.

A large proportion of the book is devoted to the London underground railways, including the several modern "tubes" and the electrification of the old steam lines. But the description is so confused with reference to streets and localities and so inflated with the verbosity of a newspaper writer trying to fill space, that even a Londoner would find himself confused as to the geographical relations of the lines after wading through the matter, while to anyone unfamiliar with the city much of the matter would be meaningless. There is no map to explain the relation of the routes and levels of the various lines. A separate chapter discusses the shallow subway system, as adopted in Paris, New York and Boston. The London County Council has decided to make a trial of this system.

Perhaps one of the most interesting parts of the book is that which relates to the London street railways, not on account of the technical features, but as showing the curious and powerful opposition to the construction of these lines. Street railway communication across the city does not even yet exist, as the lines are excluded from the business sections and also from the bridges over the river, so that, as the author says: "At present the lines are painfully disunited, without starting point or terminus." The London County Council has done (and is doing) much to improve the present conditions by extending and connecting the various lines, and for some ten years it has been acquiring the rights and properties of several of the individual companies. Interurban lines and the street railway system of some other English cities are briefly referred to.

Under the head of remarkable electric railways the author describes at considerable length the proposed Lartigue single-rail high-speed line between Liverpool and Manchester. This is intended to carry single cars at 10-minute intervals, making the run of 36½ miles in about 35 minutes, but as the author writes in the present tense he leads the reader to imagine that the road is in regular operation, instead of existing only on paper. In regard to motor vehicles the author expresses his preference for those operated by electric power, influenced largely, no doubt, by his pervading idea that electricity is the one thing to serve all ends. Both steam and electric omnibuses, however, appear to be in service in London. For agricultural work, again the use of electric motors is advocated, but how or where the farmer is to procure the current to run his motors is not explained.

Apart from its vagaries and what the author calls his "flights of fancy," the book may be read with interest. It will certainly give some general (though vague) idea of the vastness of the London transportation problem, and of the various attempts made and difficulties encountered not only in providing means of transportation, but also in reducing the maze of various independent and isolated systems to some harmonious relations. The problem, as a whole, however, still remains troublesome and unsolved.

The Care of Electric Plants.

CARE AND HANDLING OF ELECTRIC PLANTS. — By Norman H. Schneider. New York: Spon & Chamberlain. Flexible leather; 4½ x 6¾ ins; pp. 104; 66 illustrations in the text; 12 tables. $1.

The author addresses himself to "those who are called upon to operate a commercial or military electric plant without having had previous experience." It can be stated *a priori*, however, that the necessarily brief and superficial instruction possible in the scope of a small book is not a very safe warrant for an inexperienced person to take charge of an electric plant. With electricity as ubiquitous as it is nowadays, generating plants are found everywhere, while motors are even far more common. It is not always possible to have a highly-trained electrical engineer for the operation and care of this machinery. In any case, however, the attendant must have a general knowledge of the principles of action of electrical machinery, a knowledge of the mechanical construction, and a familiarity with the features demanding attention in handling or liable to give trouble in operation. The author aims to give all of these; he might profitably have restricted himself to the last one without reducing the size of the book.

The individual subjects treated of are: Resistance phenomena of electric current flow in wires, whether single or connected in series or multiple circuits, and the determination of wire sizes; Dynamos and motors, with an elementary outline of their action, a few remarks on field excitation and armature windings, some discussion on equalizer connections, and instructions for starting, stopping and taking care of machines; Electric measuring instruments; Storage batteries, with a discussion of connections, charging, testing, etc.; Incandescent lamps, the principal feature treated being the testing of lamps for light-giving power, voltage and efficiency; and finally, Oil engines, in which chapter the author tells how to start and run a Hornsby-Ackroyd kerosene engine.

The author's style and language are often rather awkward, so that he says things whose meaning is not clear. Thus, when he mentions self-induction, he says:

> Where this opposing current occurs in a revolving armature it is termed counter electromotive force.

The directions for handling generating machinery are much less complete than might be expected.

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AIR-BRAKE CATECHISM.—By Robert H. Blackall, Air-Brake Instructor and Inspector with Westinghouse Air-Brake Co. Eighteenth Edition, Revised, Enlarged and Brought Up to Present Practice. New York: Norman W. Henley & Co. Cloth; 5 × 7 ins.; pp. 305; 12 folding plates, of which three are in color, and 96 figures in the text. $2.

A good idea of the demand for books treating of the air-brake may be gained from the fact that this little volume, originally published in 1898, is now in its eighteenth edition. The author states that the present edition has been extensively revised and enlarged. A notable addition is a couple of large, colored charts showing the mechanism of air-brake equipment in section, different colors being used to indicate the pressures in different parts of the system. These charts must be of very great service in making clear the operation of the brake to employees unused to mechanical drawings.

The only apparatus described in the book is the Westinghouse, and while the apparatus of other companies is of necessity interchangeable with it, the author might well have added something on the special equipment furnished by other companies, for the benefit of employees who have to use and care for it.

In the chapter on the water-brake it is stated that the reason for injecting water into the cylinders when they are acting as air compressors is because if this were not done cinders and smoke would be drawn into the cylinders. It is doubtful whether enough steam is carried into the cylinders by the ½-in. water pipe commonly used to interfere much with the suction in the exhaust nozzle. The real reason for the use of the water is to save the cylinders from being overheated and cut by the high temperature due to the air compression. The answer to a question on p. 165 also indicates that the author is not absolutely clear in his ideas on the mode of operation of the so-called water-brake.

In general, however, the matter in the book is thoroughly practical and admirably suited to the training of the men responsible for the operation of air-brakes, on whose intelligent performance of their duties the safety of the traveling public depends to a far greater degree than is often realized.

Neilson's Steam Turbine Revised.

THE STEAM TURBINE.—By Robert Neilson, Assoc. M. Inst. M. E., Lecturer on "Steam and the Steam Engine" at the Heginbottom Technical School, Ashton-Under-Lyne. Second Edition, Revised and Enlarged. New York: Longmans, Green & Co. Cloth; 6 × 9 ins.; pp. 294; tables, XXVII. plates, and 212 figures in the text. $3.60 net.

The first edition of this book was favorably reviewed in our issue of Feb. 19, last. That a second edition should now be called for is an indication of the present interest in the steam turbine, as well as of the character of the work. In the present edition, which is nearly double the size of the first one, the description of the Parsons and the De Laval turbines have been considerably enlarged and a chapter has been added in which brief descriptions are given of recent developments in steam turbine practice in Europe and the United States, such as the Stumpf, Schulz, Curtis and Seger turbines.

These descriptions, however, are very brief, and show little more than the general construction of the various turbines. Scarcely a hint is given of the big problem which designers of steam turbines have been wrestling with for years, which is, in brief, how to make a practical commercial machine out of the steam turbine. The general principles of turbine construction are now well understood and are open to the use of all designers alike; but the question has been how to design a machine that will not contain an impracticable number of parts, that can be built by machine shop methods and without the use of an undue amount of hand labor; that will be as reliable in all contingencies as the reciprocating engine; and that will appeal to the purchaser as a distinct advance in engineering which he can safely install. There are indications that these problems have been best solved by some who were last to enter the field.

It is fair to say, however, that a large part of the story of the steam turbine's development is likely to remain unwritten history, and that the author is not to be blamed for failure to make public the information which is kept secret by the companies that have been working on steam turbine development, and have won their way past various failures, obstacles and discouragements to final success.

ELECTRIC TOY MAKING FOR AMATEURS—Including Batteries, Magnets, Motors, etc. By T. O'Conor Sloane. Fifteenth Edition, Revised and Enlarged. New York: Norman W. Henley & Co. Cloth; 5 × 7 ins.; pp. 183; 70 figures in the text. $1.

A book on toy making seems particularly appropriate for the Christmas season. Every youngster of a "mechanical turn of mind" likes most of all to make things that go by themselves, and in the present day he must have them go by electricity. He can get all the suggestion he needs for this purpose from Mr. Sloane's book. Since the book contemplates using only primary cells as the source of electricity, it will not tempt its boy reader to monkey with the electric light wiring of the house, and may therefore be considered safe reading.

ARITHMETIC OF ELECTRICITY.—Being a Practical Treatise on Electrical Calculations of All Kinds Reduced to a Series of Rules, Each Rule Illustrated by One or More Practical Problems, with detailed solution of each. Followed by an extensive series of tables. By T. O'Conor Sloane. Sixteenth Edition, Revised and Enlarged. New York: Norman W. Henley & Co. Cloth; 5 × 7 ins.; pp. 162; diagrams and tables. $1.

The scope of this collection of rules, as may be imagined, is not sufficiently wide to cover the entire field of electrical work, but it covers a good part of this field well. The illustrations, of which there are only a few, seem to have suffered from the wear and tear of fifteen previous editions.

ON THE USE OF INFLUENCE LINES IN GRAPHIC STATICS.—By Myron S. Falk. Reprinted from the School of Mines Quarterly, Vol. XXIV., January, April and July, 1903. New York: The Author, Columbia University. Paper; 6 × 9 ins.; pp. 119-455; folding plates and figures in the text.

The three papers reprinted in this pamphlet form a compact discussion of the use of influence lines in the analysis of statically determinate plane frames, as bridge trusses, according to American practice. The author shows how the algebraic criteria for maximum shear and moment are derived from the respective influence lines for shear and moment and how the wheel-load diagram is used to find the moments and shears.

HANDY LUMBER TABLES.—Containing Board Measure, Plank Measure, Scantlings Reduced to Board Measure, with Other Useful Data and Memoranda. New York: The Industrial Publication Co. Paper; 5 × 7 ins.; pp. 24. 10 cts.

The title describes the pamphlet sufficiently, except it may be explained that the "other handy tables" are mostly brief and relate chiefly to the weights of different kinds of timber and their relative hardness and strength.

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A Biographical Calendar.

A CALENDAR OF INVENTION AND DISCOVERY.—Compiled by John Cassan Wait, Attorney and Counselor at Law and Civil Engineer. New York: McGraw Publishing Co. Flexible cloth, with flap; 4¾ x 6 ins.; pp. not given; plates. $1, or 60 cts. for wall or desk form.

Mr. J. A. L. Waddell has recently voiced a regret that the history of engineering and of engineers is to a very great degree unrecorded and unknown, even to engineers themselves. The little volume here noted relates to the work of inventors rather than engineers; but naturally not a few engineers find mention in its pages.

The book has a leaf for every day in the year. The left-hand page contains brief biographies of two noted persons who have contributed materially to the industrial progress of the world, and whose birth or death occurred on the day of the year which stands at the head of the page. Following this is a brief statement of their discoveries or inventions, or the great works erected or created by them. It also contains two to four poetical selections describing or illustrating the sciences, industrial arts, invention or discovery. These selections have been chosen and applied appropriately to the inventor or discoverer or to the subject in which he wrought or studied. At the bottom of each page are given, in chronological order, the important events leading up to or resulting from the invention or discovery described. The facing page is left blank for use for memoranda or as a diary.

The curious plan of the book required its compiler to find for each day of the year two persons whose birthday or date of death fell on that day. To combine with this requirement the task of selecting inventors and inventions of most prominence and best worthy of record must have caused much difficulty. For instance, if it happened that half a dozen great inventors were all born on one day, four of them must be discarded or else recorded under their death days, which might likewise happen to be overcrowded.

The writer of the present review observes with regret that his own birthday is already appropriated by two such illustrious inventors as Benjamin Franklin and Thaddeus Fairbanks, from which it would appear that the only way for him to obtain access to future editions of the book would be first to acquire the necessary degree of fame and then to die on a day not already claimed by brighter stars.

On the other hand, the compiler must have been hard put to it occasionally to find men who were born or who died on a certain date and who were entitled to rank with the great inventors. This latter difficulty, doubtless, led to the inclusion of some names of living engineers, which are, to say the least, no better entitled to fame than many that were not so included. It also led, we presume, to the inclusion of some ancient Greek worthies, the exact date of whose birth or death is unknown.

Considering these limitations and difficulties under which the compiler worked, his success has been surprising. In fact, he has come as near making a fair and up-to-date catalogue of the great inventors as anyone in recent times whom we now recall.

The book is printed on very thin paper, which has been a great disadvantage to the few half-tone illustrations that have been used.

Notwithstanding the form in which it is issued, it deserves a place in every engineering library as a contribution to the history of invention and inventors, a branch of technical literature which, as has recently been pointed out, has been too much neglected.

Poor's Manual of Railroads.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES.—Street Railway and Traction Companies, Industrial and Other Corporations and statements of the Debts of the United States, the several States, Municipalities, etc. Thirty-sixth Annual Number, 1903. New York: Poor's Railroad Manual Co. Cloth; 6 x 9 ins.; pp. xvi. + 1675 + index, etc.; tables and colored and other maps. $10.

"Poor's Manual" is too well known to need a descriptive analysis here and too favorably known to demand any words of praise. It may be said, however, that its successive issues include far more information about steam and street railways than is to be found elsewhere, and that in addition they contain many statements relating to industrial corporations other than railways, and concise summaries of National, State and municipal indebtedness. All steam and street railways are included, but no attempt is made to give information regarding all industrial corporations. Of steam railroads the present issue covers 2,043 corporations, having 203,132 miles of completed road on Dec. 31, 1902. The city and suburban railways included number 1,177, and the industrial companies number 236. Three sets of tables are given, showing the dividends paid from 1896 to 1903, inclusive, by steam and street railroads, and by industrial companies. The usual directory of railway officials occupies 80 pages.

The Introduction contains a mass of valuable and interesting tables, summarizing the railroad statistics for the year 1902, and also for various comparative annual and decennial periods. Some of the figures in the Introduction, taken from advance sheets, were published in Enginering News, for Nov. 19, 1903.

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THE UNDERGROUND WATERS OF ARIZONA.—Their Character and Uses. By W. W. Skinner, Associate Chemist Arizona Experiment Station. Tucson, Ariz.: Experiment Station. Paper; 6 x 9 ins.; pp. 24; tables and one half-tone view.

This is a compilation and discussion of the results of chemical examinations of water from the underflow of the Santa Cruz and Salt River valleys, from numerous artesian wells, and from miscellaneous sources. The determinations include total soluble solids, chlorides, and the so-called salts causing alkalinity and hardness.

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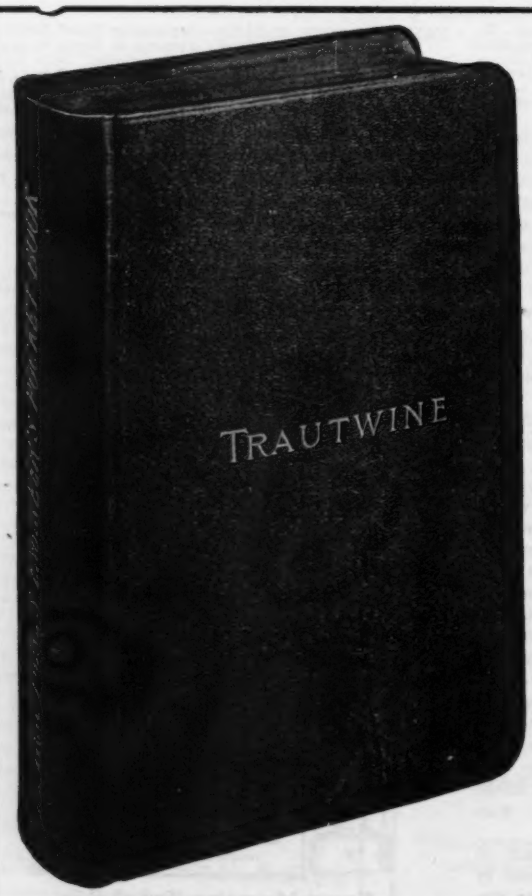

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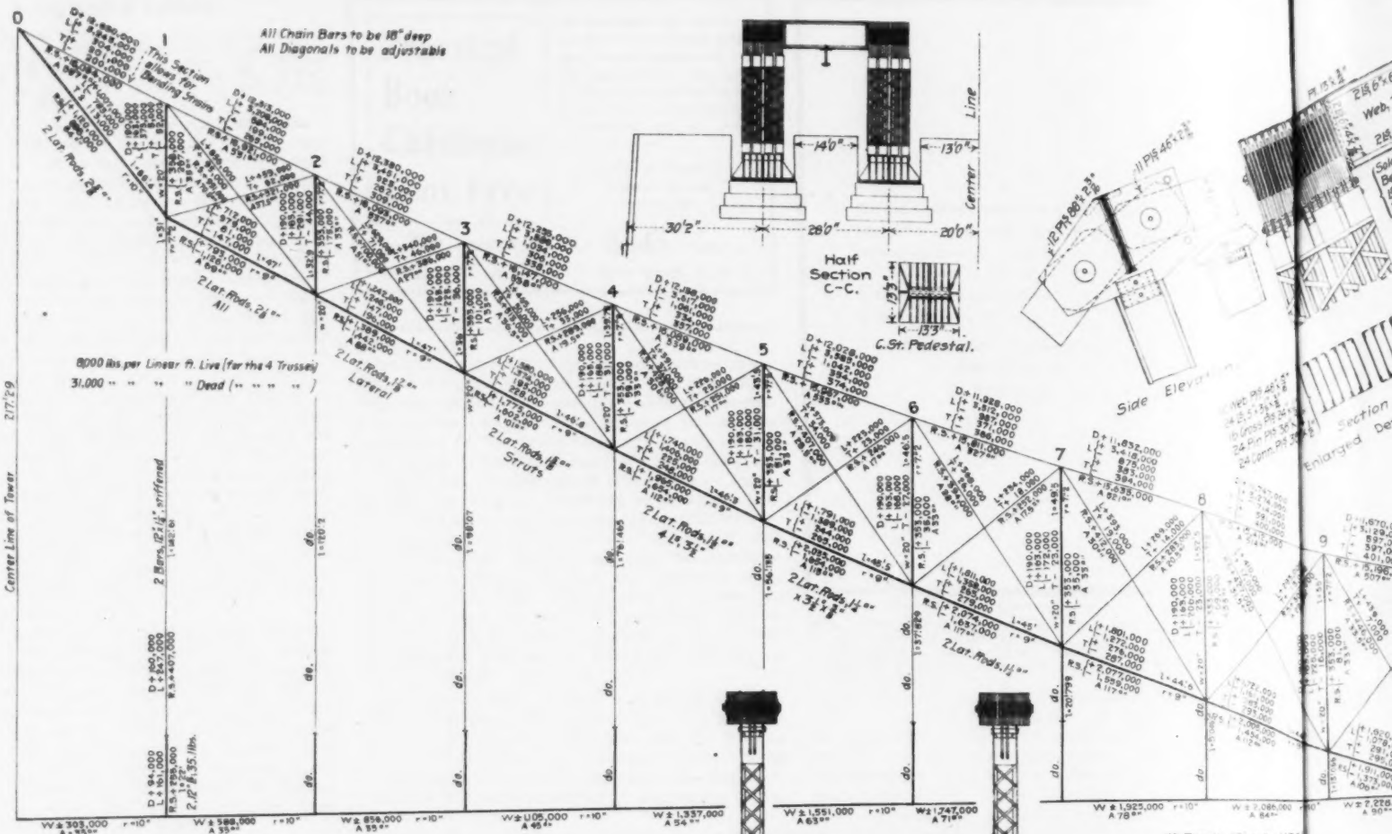
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FIG. 5. STRAIN AND SECTION SH
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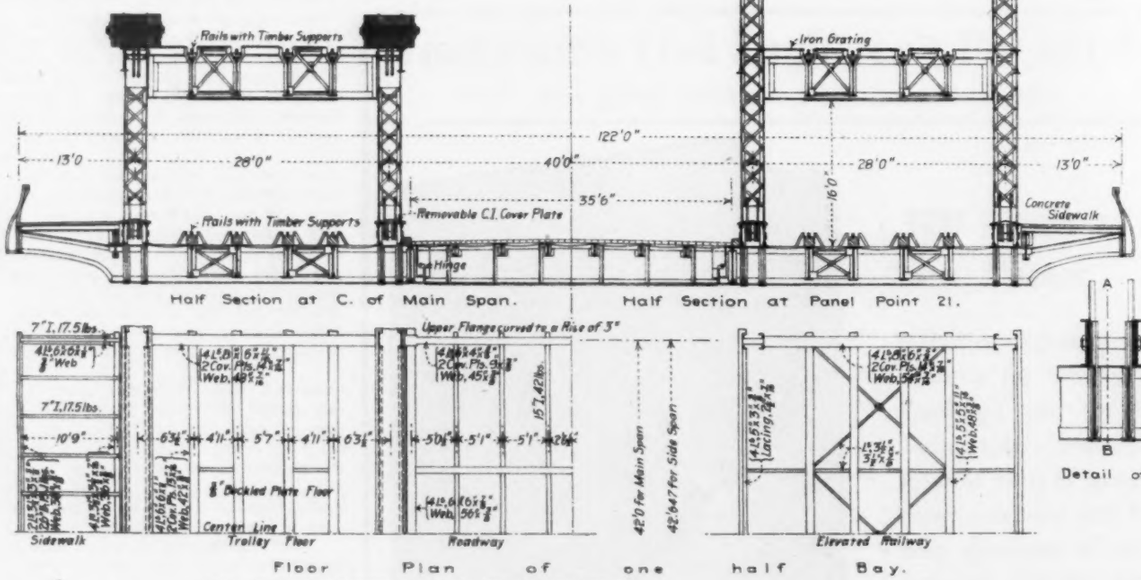


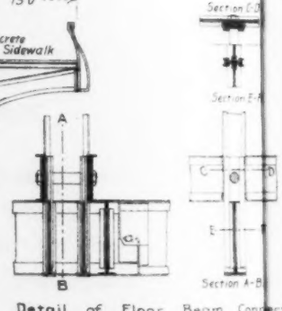


FIG. 3 TRANSVERSE SECTION AND FLOOR PLAN.

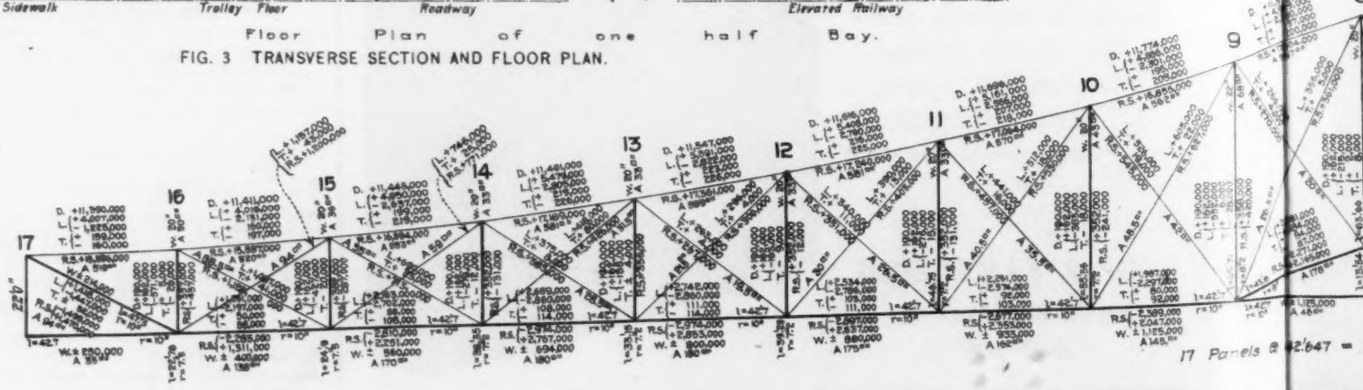


FIG. 4. STRAIN AND SECTION SH

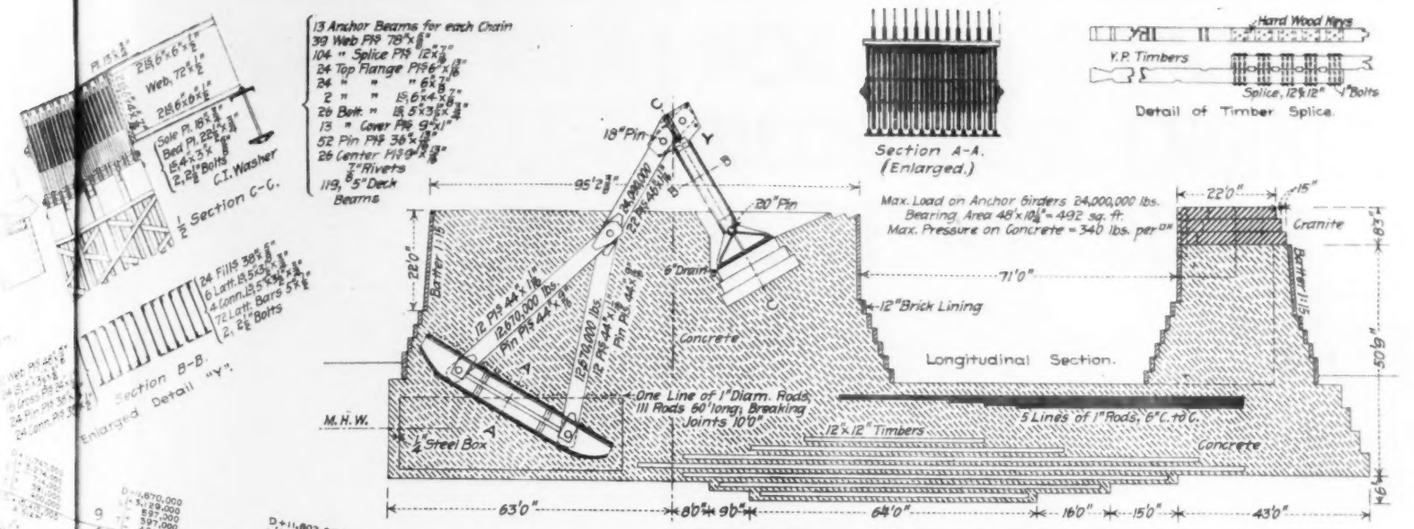
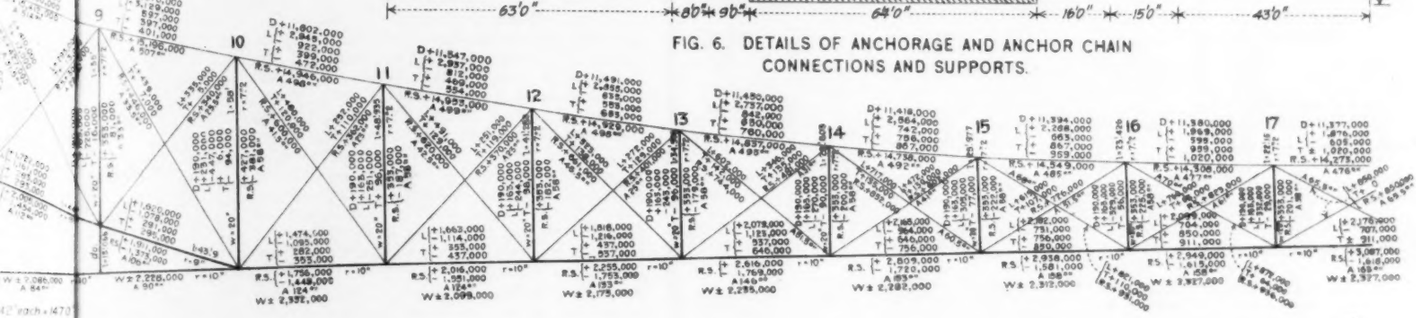


FIG. 6. DETAILS OF ANCHORAGE AND ANCHOR CHAIN CONNECTIONS AND SUPPORTS.



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D = Dead Load
L = Live "
T = Temperature
R.S. = Resultant Strain
A = Gross Area
ℓ = Length
r = Radius of Gyration
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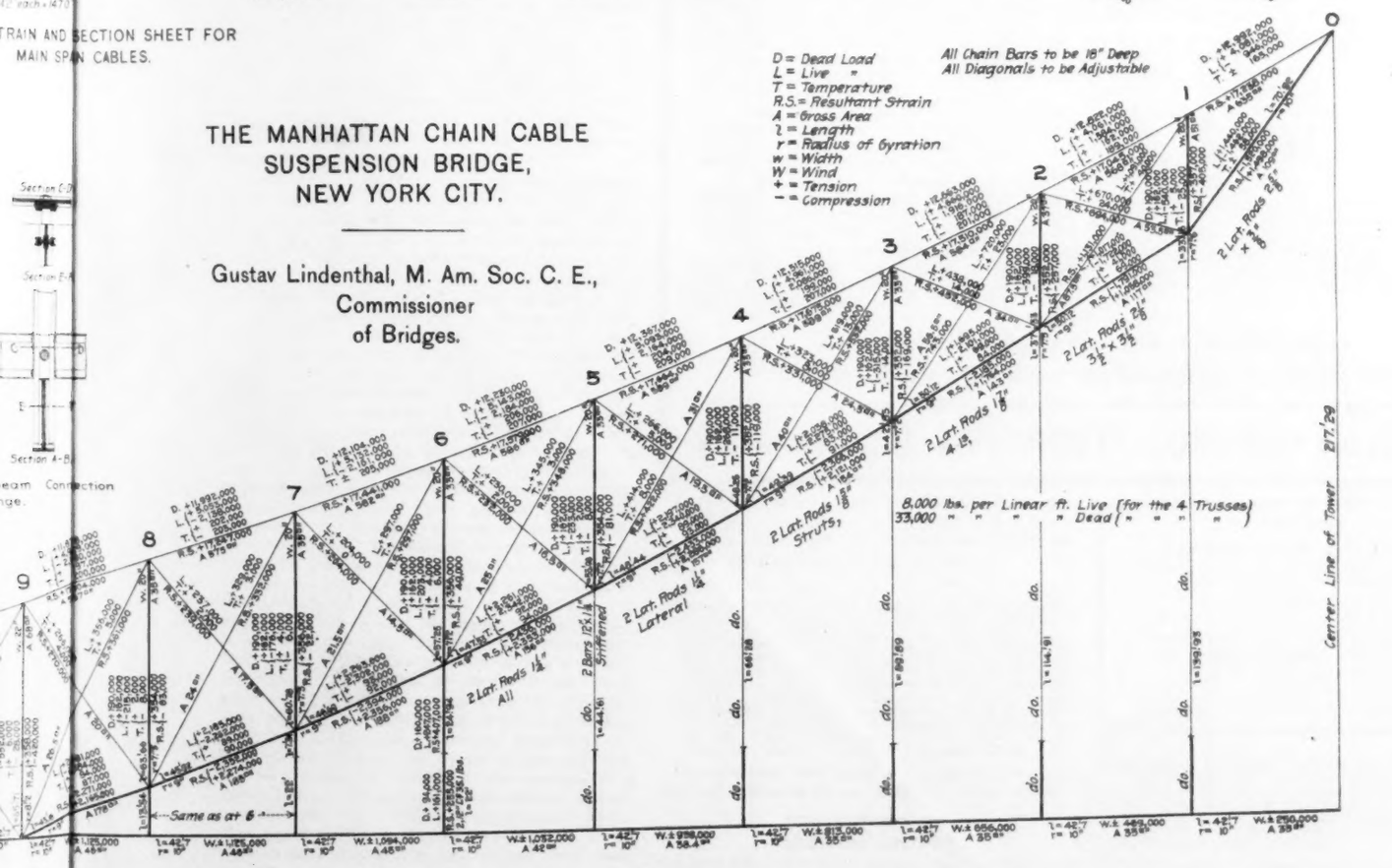
2 Lat. Rods 2 1/2" x 3 1/2"
2 Lat. Rods 2 1/2" x 3 1/2"
2 Lat. Rods 1 1/2" 4 Lg.
2 Lat. Rods 1 1/2" Struts,
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A New Edition of Wilson's Irrigation Engineering.

IRRIGATION ENGINEERING.—By Herbert M. Wilson, M. Am. Soc. C. E., Geographer and Former Irrigation Engineer, U.S. Geological Survey. Fourth Edition, Revised and Enlarged. New York: John Wiley & Sons. Cloth; 6 × 8 ins.; pp. 573; many tables, 41 plates, and 142 figures in the text. $4.

The present is the second revision and enlargement of this book since its original publication in 1893 (see Eng. News, March 30, 1893, and July 29, 1897, for reviews of the earlier editions). The present edition contains 222 more pages and 54 more illustrations than the first one, and 35 more pages and 20 more illustrations than the second edition. As might be expected, the present book is much more useful than the one published ten years ago. As compared with the edition of 1896, there is far less choice, as is partly indicated by the relatively small increase in size. In fact, the author states in his preface that "the present revision does not affect any portion of the book radically, though it has been sufficiently thorough to affect every portion more or less." The "greatest amount of textual change" is in the sections devoted to masonry, rock-fill, and combined masonry and steel dams. Under sub-surface water sources, Professor Slichter's recent studies of underground flow have been noted, while "the chapter on rainfall and run-off of streams has been brought up to date and extended." The changes in the last-named chapter include more recent statistics, up to 1900. The revision of the bibliographical references at the end of some of the chapters is not so thorough as one would wish.

For the benefit of those who are not familiar with the earlier editions of this work, which went under the title "Manual of Irrigation Engineering," the following outline of the contents is given: The book is in three parts. Part I., "Hydrography," takes up precipitation, run-off, stream flow, evaporation, absorption, seepage, alkali, drainage, sedimentation, duty of water, measurement of water in open channels, underground waters, and the use of sewage for irrigation. Part II., "Canals and Canal Works," includes the design of canals, diversion weirs, sluices, regulators, flumes, drops or falls, and closed conduits, and the application of water to land. Part III., "Storage Reservoirs," includes reservoir sites and capacities, dams of earth, rock-fill, and masonry, wasteways and outlet sluices, and pumping, tools and maintenance.

It will be seen that some of the topics treated really have little or no connection with the subject indicated by the headings to the parts under which they are placed, a statement particularly true of "pumping, tools and maintenance." It may be added that the information on dams is separated, through the inclusion in Part I. of diversion weirs, which covers timber and rock dams and low masonry dams. The flow of water in open channels falls in Part I., "Hydrography," while closed channels are treated in Part II., "Canals and Canal Works." These are not serious faults, but they suggest the possibility of a more logical arrangement of topics. Such an arrangement, we think, would clearly show how largely this and other books on irrigation engineering duplicate portions of the matter found in books on hydraulics and public water supplies, and would indicate the desirability of using the space gained by avoiding such duplication to present more information pertaining to irrigation alone. We say this not so much in criticism of this book as in the interests of future works on the subject. It has been urged against the earlier editions of this book (see letter from "Uinta," in this issue), that they did not fulfil the promise of the title and the table of contents, but we may note that "Manual of" has now been omitted from the title, and that some of the deficiencies of the first edition have been made good. Moreover, those who expect to find between the covers of a single book all the information needed in the practice of a whole branch of engineering are doomed to disappointment. To a large extent the comprehensive treatise must hereafter give place to series of monographs; and the man of one book must become the man with a well-stocked library.

Finally, while there is still much room for improvement in this book (and of what book is that not true?) Wilson's "Irrigation Engineering" still continues to be as it has been for some years past, the only available comprehensive book on the subject published in this country.

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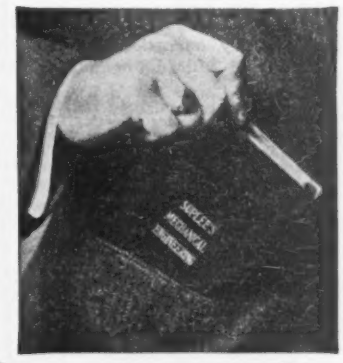

MR. SUPLEE is technical and mechanical editor of *The Engineering Magazine*, and *The Engineering Index;* and an author of international reputation.

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The character and scope of this handy directory are well indicated by the sub-title, given above.

Publications Received.

CHANGE GEAR DEVICES.—Showing the Development of the Screw Cutting Lathe and the Methods of Obtaining Various Pitches of Threads. By Oscar E. Perigo. New York: Derry-Collard Co. Cloth; 6 × 8 ins.; pp. 81; frontispiece portrait and figures in the text. $1.

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INDUSTRIAL USES OF WATER.—By H. De La Coux, Chemical Engineer, Expert to the Council of the Prefecture of the Seine, Professor of Applied Chemistry, etc. Translated from the French and Revised by Arthur Morris. London: Scott, Greenwood & Co. New York: D. Van Nostrand Co. Cloth; 6½ × 10 ins.; 135 figures in the text. $4.50 net.

PROCEEDINGS OF THE NATIONAL GOOD ROADS CONVENTION: Held at St. Louis, Mo., April 27 to 29, 1903. Pub. doc.; United States Department of Agriculture, Washington, D. C. (Office of Public Road Inquiries, Bulletin No. 26). Paper; 6 × 9 ins.; pp. 80.

Literary Magazines.

"Road Building Among the Moros" is the title of a paper by Major R. L. Bullard in the December "Atlantic," in which is described the work of building roads in the Malanao country in the island of Mindanao. These roads were located by Gen. Geo. W. Davis, and their construction was begun by Gen. Baldwin in the spring of 1902. Major Bullard tells how by the exercise of infinite tact, patience and forbearance, the Moros were at last hired to work on the roads, so that the road from the south coast to Lake Lanao was finished with their labor. In all probably 3,000 Moros worked side by side with the Americans, and from being at first a mere adjunct to the soldier labor, they came finally to do the great bulk of the work.

It makes one doubtful of the value of the present military operations against these people to read Major Bullard's opinion as follows:

> Among the Moros human life is cheap—ten or twelve dollars—and scenes of blood and tales of carnage are not so rare as to be very affecting. In defeat all Orientals expect far more slaughter than Westerners have ever been willing to make or even think of. Punitive expeditions are necessary and valuable, but let us not overestimate them.

Another of the savage peoples of the world, the Touaregs of the Sahara, are described by Mr. W. J. Harding King in this month's "Harper's."

"Home-Made Windmills of the Prairie States" are described in the December "Cosmopolitan." The numerous types described well exemplify the ingenuity of the farmers who have made them.

Isthmian canal matters take up a good share of the space in this month's "Review of Reviews;" and there is a special article on M. Philippe Bunau-Varilla, who, as our readers are doubtless aware, is a civil engineer as well as an up-to-date diplomat. The same magazine contains another article on the Moros and their country, written by Chaplain Cephas C. Bateman, of the 28th Infantry, Mr. Bateman declares that the road building in the Moros country above referred to has been the event of chief importance during the past year.

In the "World's Work" for December we find two interesting studies of American agricultural conditions, one in the "Corn Belt," written by Prof. T. N. Carver, of Harvard University, the other a general review of current progress in the farming industry by Prof. B. T. Galloway, of the Department of Agriculture.

The submarine boat and its naval position is discussed by Mr. A. S. Hurd in the "Nineteenth Century" for November. His views may be judged from the fact that his paper is entitled "The Success of the Submarine." It is interesting to recall that only a few months ago the British navy and nation looked upon the submarine boat as an inventor's dream, unworthy of serious attention.

"The Importance of Cost-Keeping to the Manufacturer" is the title of a paper in the "Annals of the American Academy of Political and Social Science." The author, Mr. Conrad N. Lauer, in "ng forth the value of cost-keeping systems, dec[illegible] lager cannot adjust wages with judicial [illegible] less he has before him a personal acco[illegible] with each man employed, and he cannot hav[illegible] this record unless he has a complete system c[illegible] counting." The following extract is of inte

> A few years ago a machinist would be fined for wearing out a tool. To-day the wise manager pays the man a premium for wearing it out—with the proviso, of course, that he accomplishes the work that the tool is capable of performing.
>
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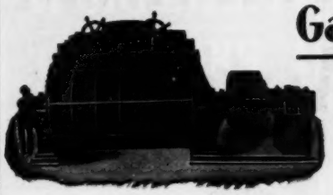

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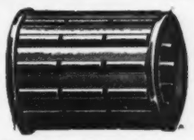

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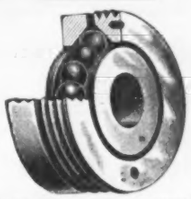

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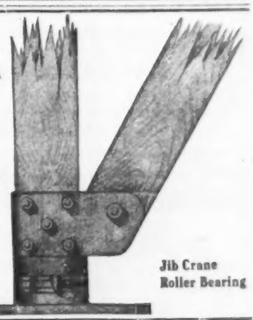

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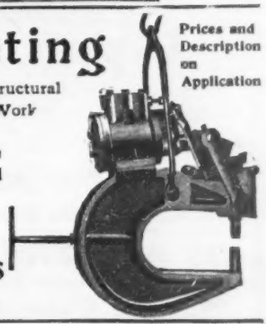

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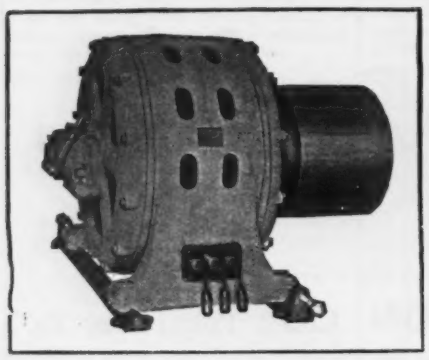

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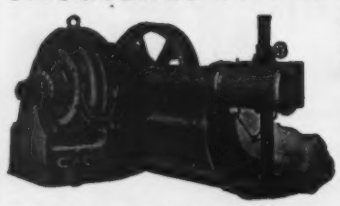

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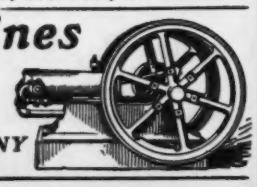

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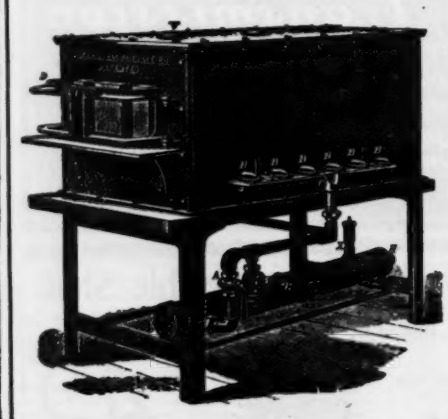

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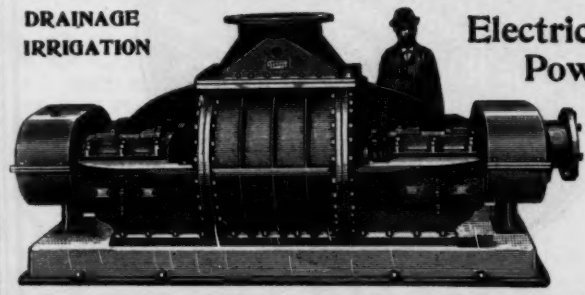

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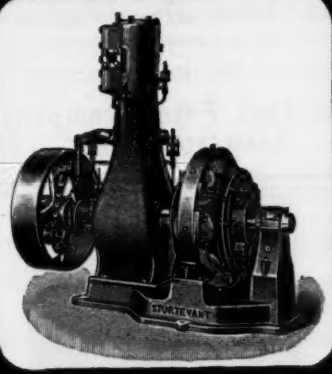

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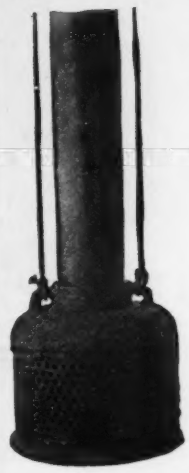

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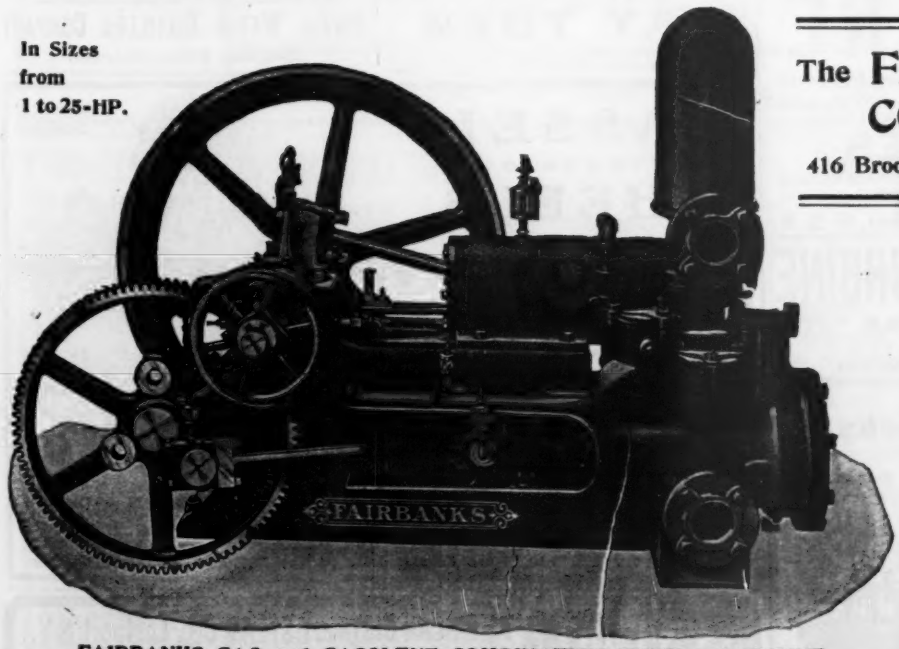

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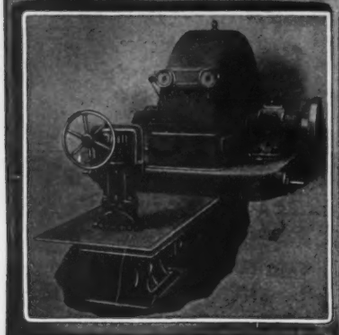

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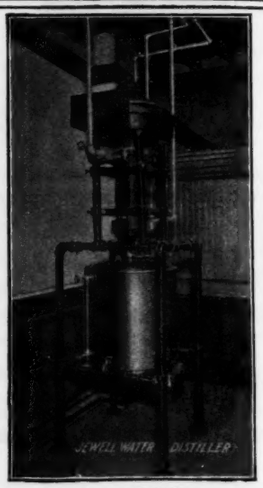

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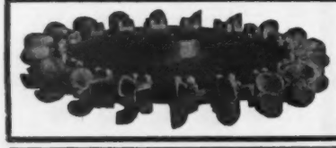

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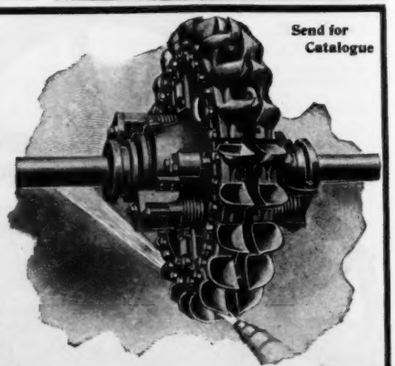

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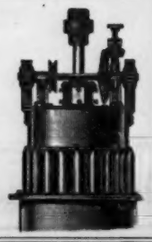

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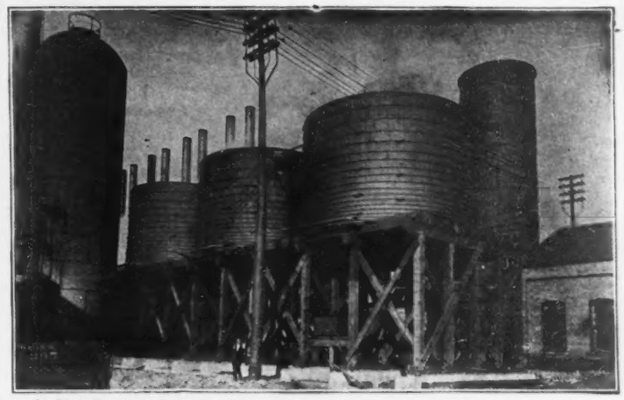

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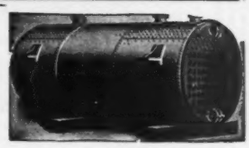

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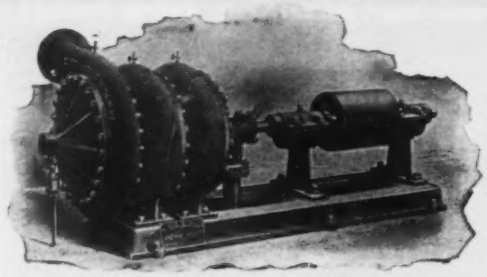

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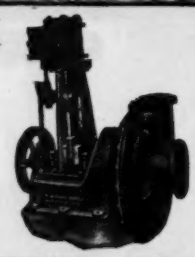

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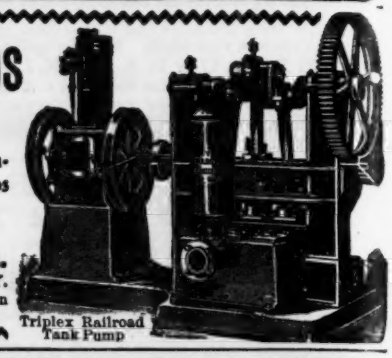

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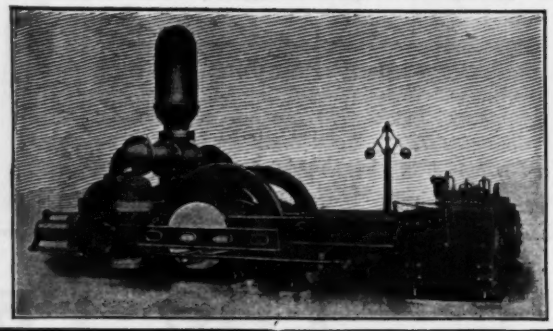

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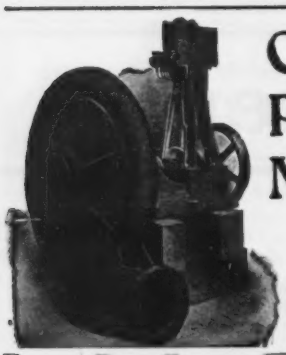

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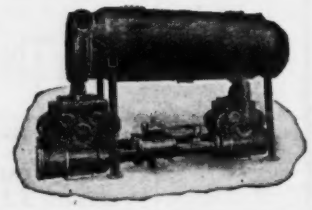

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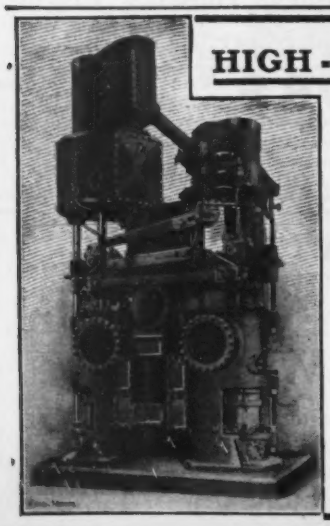

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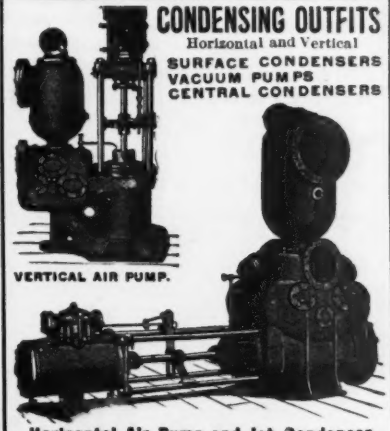

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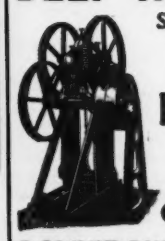

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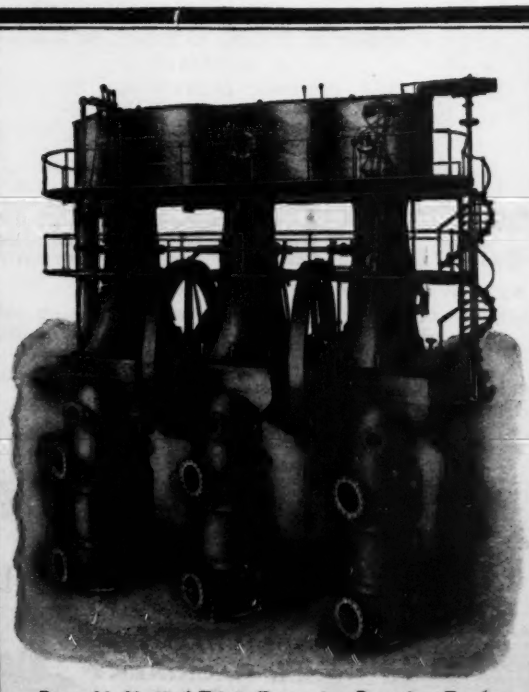

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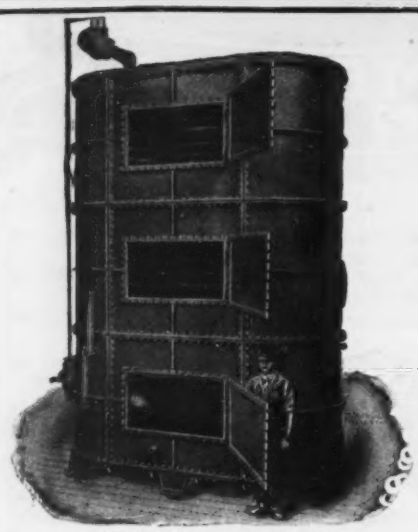

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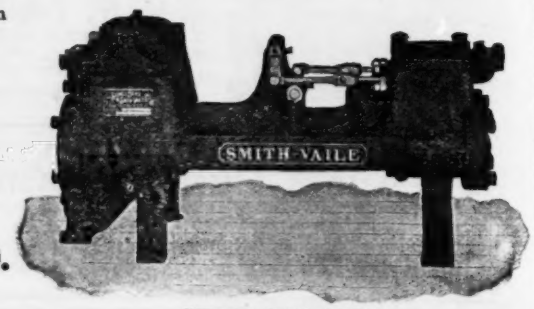

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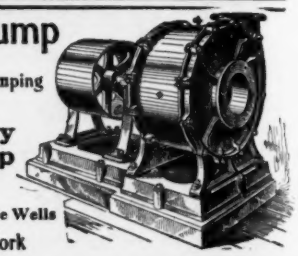

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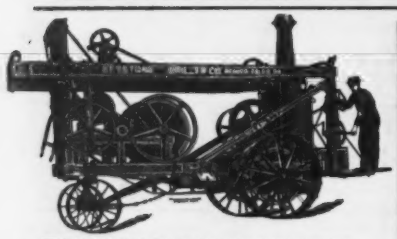

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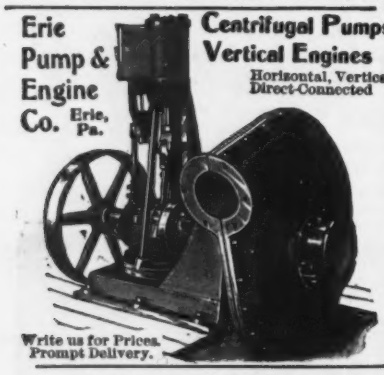

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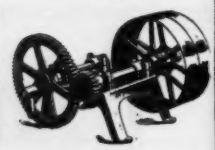

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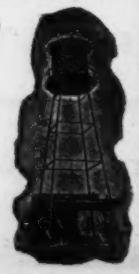

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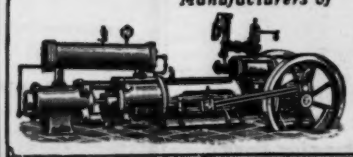

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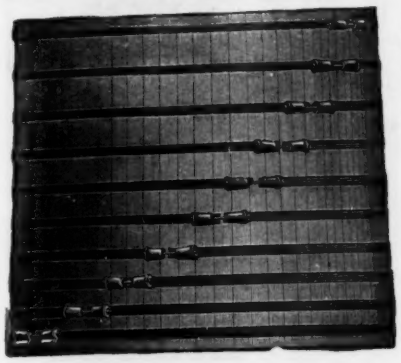

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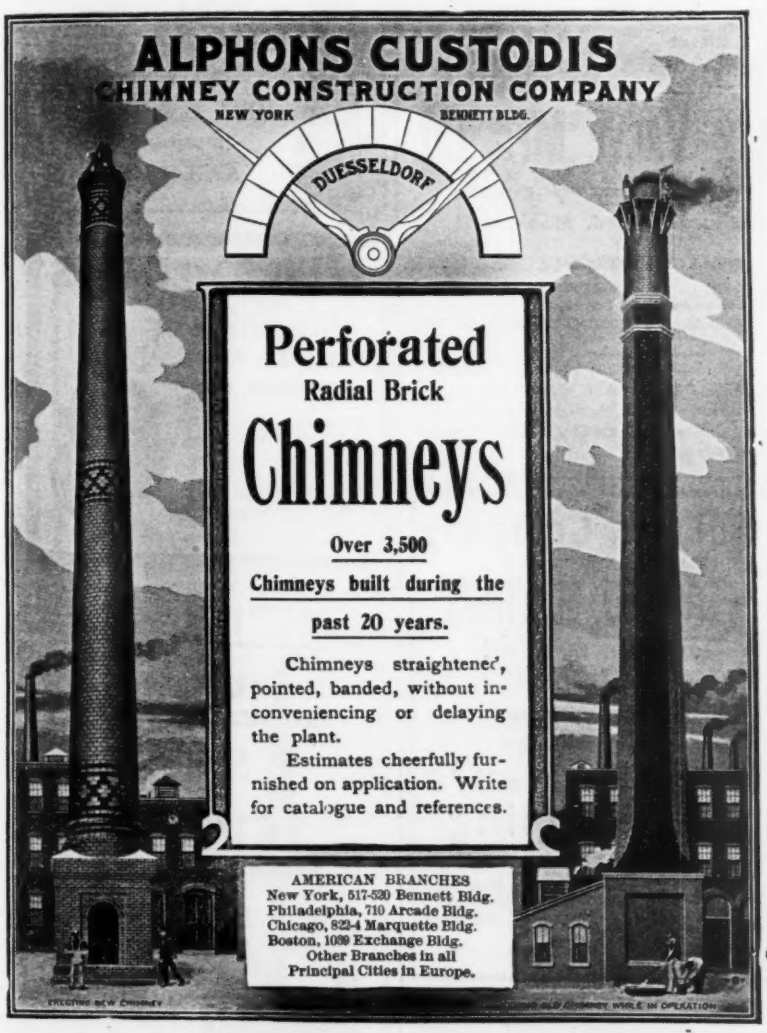

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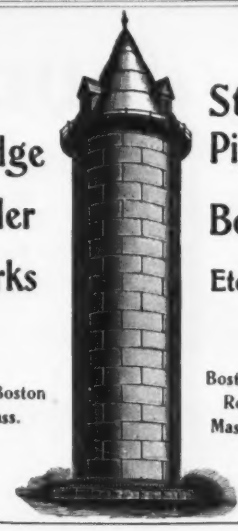

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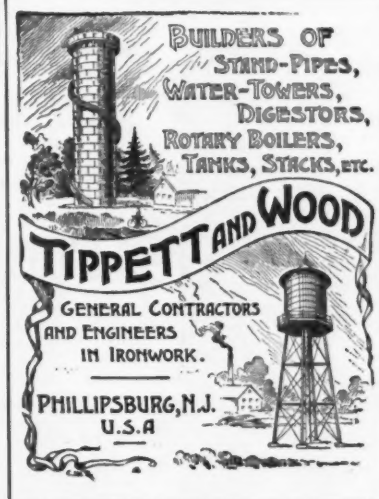

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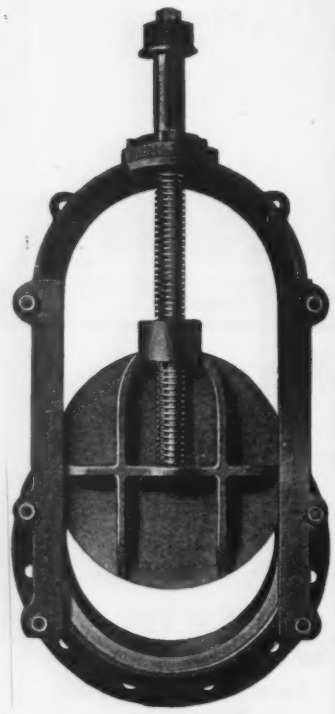

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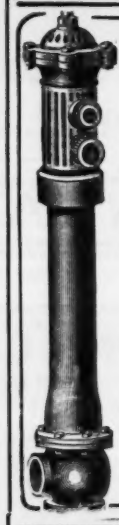

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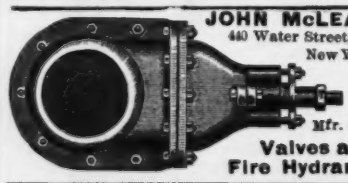

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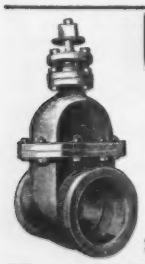

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"	1895	14,076
"	1896	15,542
"	1897	16,115
"	1898	20,062
"	1899	25,145
"	1900	26,414
"	1901	23,126
"	1902	24,635
		177,927
1903—to April 27		6,332
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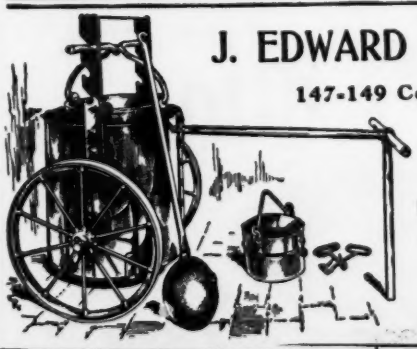

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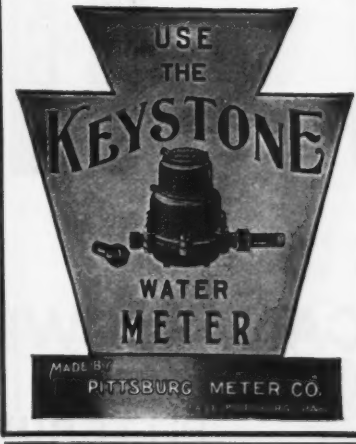

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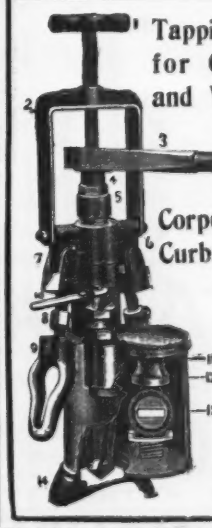

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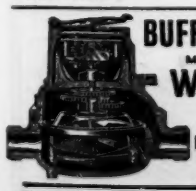

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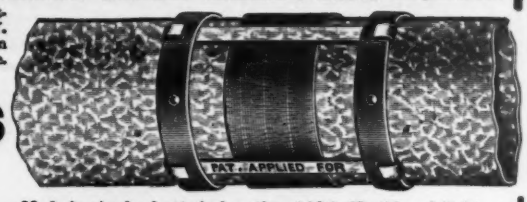

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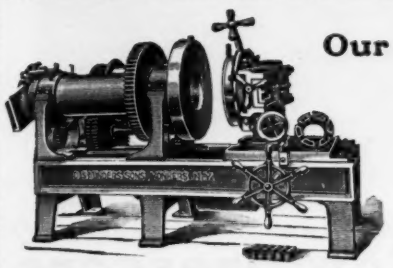

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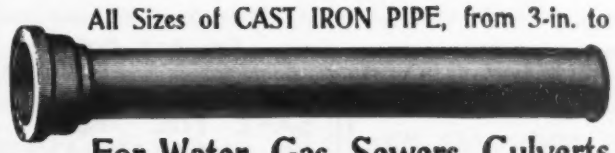

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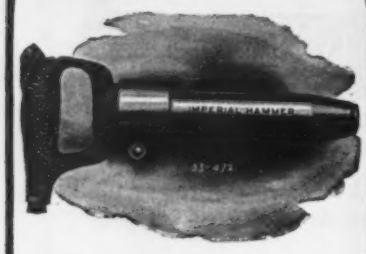

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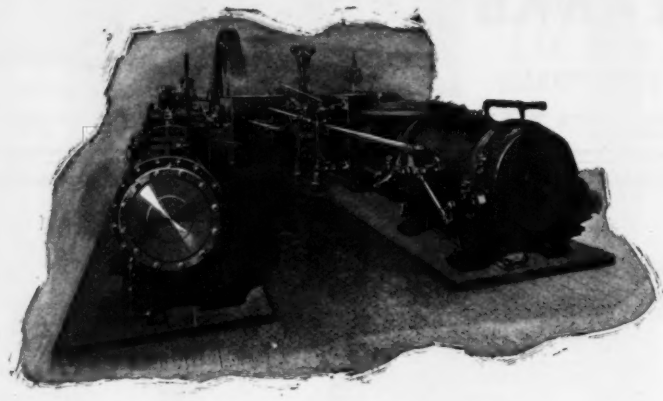

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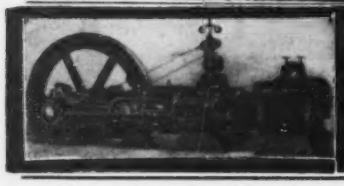

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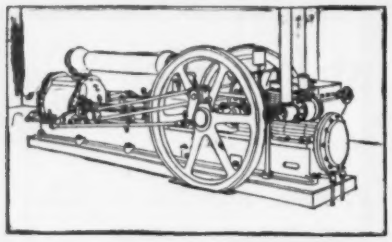

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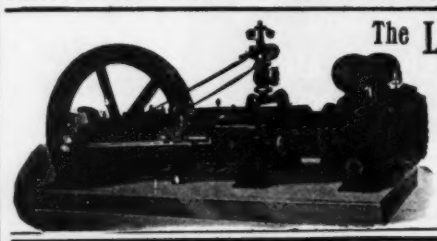

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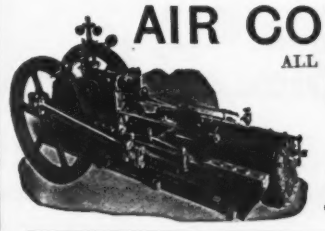

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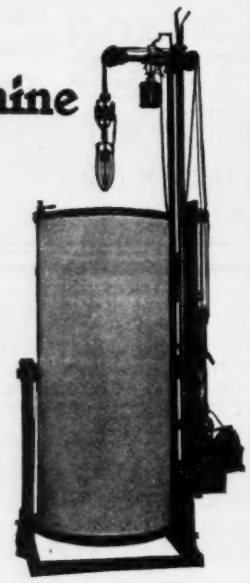

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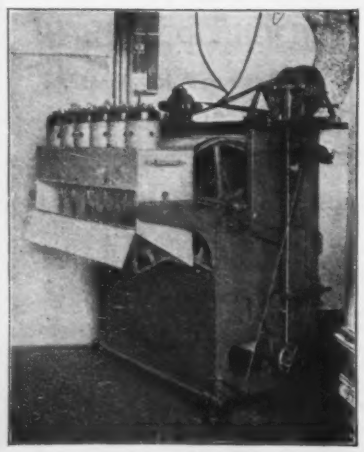

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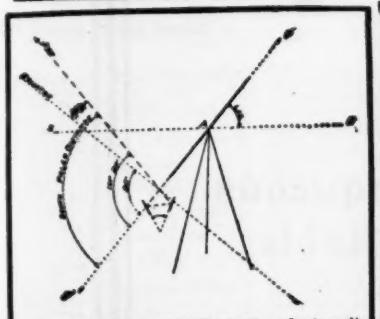

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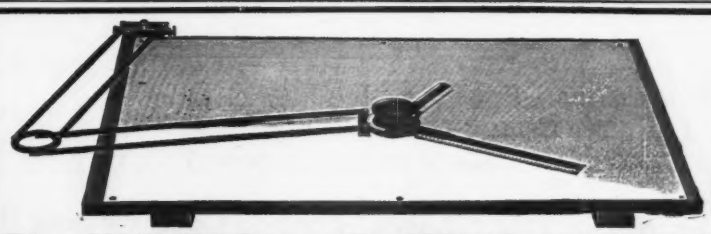

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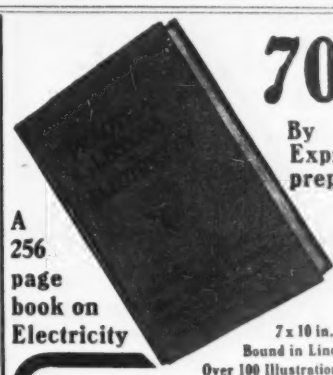

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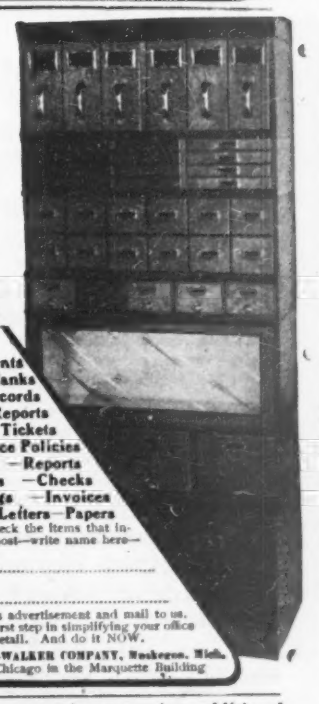

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3 " " " 60 " x 16 "
9 " " " 72 " x 18 "

CYLINDER BOILERS

8 Boilers, 40 ft. long x 34 ft. diameter, good for 100 lbs. steam pressure, without fixtures or fittings.

ENGINE

1 20 x 40-in. Buckeye, Girder Frame, Band Wheel, in half 12-ft. x 31-in. face.

RAILS

200 tons 30-lb. Steel Relayers.
200 tons 35-lb. Steel Relayers.

CARS

80—80,000-lb. Ore Hopper Cars, made by Allison Mfg. Co.
A fine lot of 32-ton Hopper Coal Cars, self-clearing.

PUMP

1 Worthington Compound Duplex Condensing Pump, 25-in.—43-in. x 17½-in. x 36-in.—20-in. suction, 18-in. discharge; capacity 3,000,000 gallons.
All of the above in A1 order and ready for immediate delivery.

1,000 ft. of 34-in. Boiler Stack, 5-16 in. material. This stack is first-class in every respect and will be sold at a bargain.

We buy and sell Air Compressors, Engines, Locomotives Rails, Cars, Bridges, Boilers, Hoisting Engines and Pumps, etc. Complete plants purchased.

A. V. KAISER & CO.
No. 222 South 3d St., PHILADELPHIA, PA.

Locomotives for Sale

Two Specials

1 18 x 22 Ten-Wheeler, Standard Gauge.
1 12 x 16 Saddle Tank, 36-in. Gauge.
Ready for immediate service. A1 condition.

J. H. Taylor Railway Equipment Co., St. Louis

FOR SALE BARGAINS

30x13 Stone Crusher.
24x48 "Wright" Engine.
Mundy No 8t, 6½x12 cylinders, 4 drums.
Deane Duplex Compound Pump, 14x26x 11x18. Outside Packed Plungers.
Relaying Rails and Locomotives.
L. E. KENNEDY & CO., 17 Broadway, N. Y.

FOR SALE OR RENT.

SOUTHER STEAM SHOVEL

Two-yard Bucket in perfect order. Specially adapted for large brick yards and cement works, under all conditions. Owner with long experience will operate shovel if required.

E. P. SMITH,
26-2t 28 Boston Street, South Boston, Mass.

FOR SALE.

Immediate delivery at an attractive price.

48-inch Riveted Steel Pipe

¼-inch in thickness tf

E. KEELER CO., Williamsport, Pa.

Saddle Tank Locomotive

Porter build; standard gage; cylinders 12x18-in.; 4 drivers; weight 18 tons. For further particulars, address, tf

BENJAMIN WATSON
66-70 Beaver St., (Coffee Exch. Bldg.) New York

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RAILROAD TIES,
Car and Railroad Lumber; White, Yellow Pine and Oak Sawed to Order.
Cypress Shingles and Lumber
120 LIBERTY STREET, NEW YORK

RED CEDAR PILING, POLES AND POSTS, ALL LENGTHS
J. P. MEREDITH CEDAR CO., Memphis, Tenn.

FOR SALE

Space under this head is sold at the uniform rate of $1.50 an inch; minimum charge, $1.50 a week . . .

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TONS

60-lb. Relayers

ALSO

Light Section New and Relay

VERY LOW PRICES

Walter A. Zelnicker Supply Co.

Department E. I. in St. Louis

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CHICAGO NEW ORLEANS
MOBILE HOUSTON SEATTLE

FOR SALE.

1 15x22-in. Baldwin **Locomotive.**
1 Lidgerwood **Cableway.**
1 9x15-in. Blake **Crusher**
1 18x24-in. Automatic **Engine.**
2 16x18-in. Vertical **Engines.**
2 150-HP. Tubular **Boilers.**
Tupper Grate Bars, all patterns.

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Second-Hand Brick Machinery

Dry Mill, Pug Mill, Brick Machine

Shafting and Pulley for Same

Capacity of Plant, when in operation, 10,000 to 14,000 brick per day
All in first-class condition. Enquire tf
T. M. RIPLEY, - - Marietta, Ohio

COMPLETE ENGINEERS'

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Highest quality, good as new, F. E. Brandis make, 4 inch needle, inverting telescope, three screws. Great Bargain.

I. A. LEFÈVRE,
26-1t 2624 Boulevard, Jersey City, N. J.

FOR SALE.

Two Ingersoll Class A Compressors, 18-18¼ x 24; One Ingersoll Class A. 14-16x18"; One D-62 Thompson-Houston 70 K. W. Generator, 500 volts; One Westinghouse Compound Engine, 14-24x18"; Two 60 HP., One 100 HP., One 125 HP. Tubular Boilers; One 9x15 Blake Crusher with Conveyor, Screen and Engine.

J. C. SAXTON, 18 Broadway, N. Y.

FOR SALE.

Locomotive Cranes

1 New 15-ton Locomotive Crane, immediate delivery.
1 New 10-ton Locomotive Crane, immediate delivery.

THE BROWNING ENGINEERING CO.
26-6t Lock Drawer "Q," Cleveland, Ohio

FOR SALE.

A Complete Plant

consisting of Cableways, Engines, Boilers, Wagons, Flats, Derrick Boats, Traveling Derricks, small tools, etc. Send for printed list. 20-tf

BAKER & JUDSON, Morgantown, W. Va.

FOR RENT

Marion "A" Shovel

Good Condition. Immediate Delivery.

JAS. S. BRADEN
26 Cortlandt Street New York

FOR SALE.

BOILERS

Two 48-in. x 14-ft. Return Tubular Boilers, double riveted, full front, fixtures and fittings, all in first-class condition.

Price, $225.00 each.

J. B. WESTHAFER,
25-3t New Philadelphia, Ohio.

FOR SALE

See first column for rates

FOR SALE

See first column for rates

BARGAINS

DUMP CARS STEAM SHOVELS
HOISTING ENGINES LOCOMOTIVES, ETC.

Send for List
LOW PRICES
PROMPT DELIVERIES

COMMERCIAL RAILWAY EQUIPMENT CO., 120 Liberty St., New York

See advt. on page 51 Indiana Road Machine Co.

Manufacturing Plant For Sale

U. S. District Court for Eastern District of Pennsylvania.
In Bankruptcy. No. 1731.

The ENTIRE PROPERTY OF THE EDDYSTONE FOUNDRY & MACHINE CO., at EDDYSTONE, DELAWARE COUNTY, PA., consisting of about 184 acres of land, together with Foundry, Machine and Pattern Shops, Power House, Material Store Houses and Office Building, Tools, Fixtures and Stocks, will be exposed for public sale on the premises on

THURSDAY, FEBRUARY 4th, 1904, at 2 o'clock p. m.

The property is connected by sidings to both the Pennsylvania and Reading Railroads, has one thousand (1,000) feet of water front on the Delaware River, and is crossed by two trolley lines to Philadelphia and Chester.

A pamphlet containing full information may be obtained by addressing, DAVID TOWNSEND, Trustee, 624 Witherspoon Building, Philadelphia, Pa., or his attorneys.

WILLIAM C. FERGUSON, } 1001 Chestnut Street,
H. W. MOORE, } Philadelphia.
26-5t

LOCOMOTIVES, STEAM SHOVELS, CARS Prompt Shipment

1 Little Giant, friction feed, traction wheels.
1 Little Giant Special, crowding engines, S. G. trucks.
1 Style A Marion, 1⅛-yd. dipper.
1 Improved A Marion, 1¾-yd. dipper, crowding engines.
1 45-ton Bucyrus, crane pattern, 1¾-yd. dipper.
1 65-ton Bucyrus, crowding engines, 2½-yd. dipper.
1 70-ton Vulcan, 3 sets engines, 3-yd. dipper.
1 8x12 Porter 4-driver saddle tank, 24-in. gage.
2 10x14 Vulcan Saddle Tanks, 36-in. gage.
1 12x18 4-driver Porter saddle tank, 36-in. gage.
1 10x14 Baldwin Rear Tank, 14 tons, S. G.
1 12-ton Byers geared, 36-in. gage.
30 1½-yd. Western Dump Cars, 24-in. gage.
30 3-yd. Western Dump Cars, 36-in. gage.
17 1½-yd. R. & McD. Rotary Dump Cars, 36" gage.
19 3-yd. R. & McD. 1-way Cars, 36-in. gage.
10 5-yd. Western Dump Cars, S. G.

THE EDGAR S. LOW COMPANY

CHAS. REES, West. Mgr., Great Northern Bldg., CHICAGO, ILL.
General Offices, Empire Building PITTSBURG, PA.

FOR SALE.

1 18x42 Corliss Engine, H. & P.
1 Large Pulverizer for cement work.
1 Patch Gang Saw.
1 Ransome Concrete Mixer.
1 8x12 Mundy D. C. S. D. Mine Hoist.
1 7x10 Bacon Stone Crusher.
1 Boom Hoist, Mast 60 ft. x 18 in., Boom 46 ft. x 16 in.

CHARLES COUSE,
8-3t Market and Broad Street, Newark, N. J.

FOR SALE.

UPRIGHT BOILER

74 x 42 in.; 91 tubes, 2 in. diameter; about 17 HP. In operation at N. J. Steel Co., Rahway N. J.

CHARLES T. GUNN
27-2t 45 Clinton Street, Newark, N. J.

Steam Shovel TO LET

One Marion Style A 1¼ C. Y. Dipper. Standard railroad gage. Just rebuilt and latest improvements added. Is practically as good as new. Ready for immediate shipment. Experienced crew ready to go with it if desired.

Also other plant to let as heretofore advertised. tf

TROY PUBLIC WORKS CO., H. W. SHERMAN, President. 1 Mann Bldg., Utica, N. Y.

BARGAINS FOR QUICK DELIVERY.

1 No. 5 Gates **Crusher.**
Double Column **Drop Hammer Cylinder,** 14x36, fine condition.
1 125-HP. **Automatic Engine,** good as new.
1 25-ton Baldwin **Locomotive,** standard gage.
36 gage 12-ton Contractors' **Locomotives.**
1 **Bridge Erecting Engine,** 4 independent winches, with boiler complete.
4 **Guy Derricks,** 40 to 70 ft.
1 60 and 1 65-ton **Steam Shovel,** good as new.

WE SELL
Engines, Boilers, Pumps and Quarry Supplies, Concrete Mixers, Horse Rollers, Steam Drills, Air Compressors, Belting, Hose, and a full line of **Contractors' Supplies.**

CONTRACTORS' SUPPLY & EQUIPMENT CO., 232 Fifth Avenue CHICAGO

SPECIAL LOOK THINK BUY BARGAINS

STEAM SHOVELS.

3 Model A Marion, 1¼-yd. capacity;
2 Model G Marion, 2¼-yd. capacity;
1 65-ton Bucyrus 2½-yd. capacity;
3 Little Giants, 1¼-yd. capacity.
1 Model AA, 1¾-yd. capacity;
1 Model C, ¾-yd. capacity;
1 70-ton Victor, 3-yd. capacity;

LOCOMOTIVES (Standard Gage)

1 60-ton Baldwin Switcher, 6 drivers;
1 30-ton Brooks passenger type, small wheelbase, low drivers, A1;
1 52-ton Baldwin Mogul, 1 year old;
1 50-ton Baldwin Consolidation;
2 Baldwin saddle-tank; 18 ton.

Also lot of 36" gage, 8, 10, and 12 ton Saddle-tanks.

FLAT CARS. DUMP CARS. EIGHT PASSENGER COACHES.

40 30-ton, 20 25-ton, 30 20-ton, and 13 12-ton (36" gage) Flats.
20 5-yd. Dump Cars, standard gage;
31 Dump Cars, 3-yd., 36" gage.

Brasses, Switches, Turntables, Etc.

APEX EQUIPMENT COMPANY, 11 Broadway, N. Y.

Our Bargain List of Material

When you are in the market for Supplies of any kind, consult us before placing your order. Our establishment is the LARGEST in the world. Our Main buildings and Warehouses cover 20 acres of land. All of the material that we offer for sale is in our stock ready for immediate delivery.

If you are in a special rush for any material, telegraph us at our expense for quotations.

We invite you to call and inspect our Institution when in the city. Five long-distance 'phones; all yards 827. We use Western Union and A.B.C. codes.

RADIATION

50,000 ft. factory radiation, sizes from 25 to 200 sq. ft. of heating surface each; for single and two-pipe systems. All shapes. Price, per sq. ft. heating surface....15½ cts.

PIPE

Our Stock consists of the following quantities. It is all in good condition ready for immediate use; re-threaded; new couplings:

50,000 ft. of	⅜-in.;	8,000 ft. of	6-in.;
68,000 " "	1-in.;	1,000 " "	7-in.;
110,000 " "	1¼-in.;	2,000 " "	8-in.;
6,000 " "	1½-in.;	900 " "	9-in.;
45,000 " "	2-in.;	1,500 " "	10-in.;
87,000 " "	2½-in.;	1,400 " "	12-in.;
4,000 " "	3-in.;	400 " "	14-in.;
13,000 " "	4-in.;	400 " "	16-in.;
2,000 " "	5-in.;	250 " "	18-in.,

Also
150,000 ft. 3½-in. light-weight pipe. Per ft. .....11 cts.
165,000 ft. 4-in. light weight pipe. Per ft. .....15 cts.

IRON ROOFING

2,400 squares of good second-hand galvanized Iron Roofing in heavy gages, running about No. 22. Sheets are miscellaneous sizes, it is practically free from nail holes; has been nicely trimmed; 2½-in corrugated and is perfectly serviceable for further use. Price per square $3.00

Also 1,400 squares, same as above in black steel. Price per square.....$2.50
Also new roofing.

FELT ROOFINGS

10,000 rolls of new, high grade Felt Coverings. It is perfect material, fully guaranteed. We offer

2-ply, per square	$1.15
3-ply, per square	1.35
Vulcanite, per square	1.50
Ruberoid, per square	1.75

Samples on application. Special prices in large lots.

VALVES

250 fine second-hand Globe, Angle, Check, Gate and pressure valves; sizes 2½ to 14 ins. These valves are perfectly tight and are guaranteed. We will save you at least 50%.

INCANDESCENT LAMPS

Guaranteed new; put up 250 in original barrels just as they came from factory. They are not refilled, but are sold to you with the understanding that if upon trial you do not find them satisfactory that we will give you authority to return them to us at our expense for return charges. Can furnish voltages 100 to 115; candle powers 8, 10, 16, 20, and 25. Bases: Edison and T.-H. We name you price on these lamps in barrel lot, with Edison base, each.....9½ cts.
T.-H. base, each .....10¼ cts.

WIRE ROPE

We have in stock a quantity of fine second-hand Wire Rope, six strands, 19 wires to the strand, which has not seen excessive service and which is in first-class condition for further use:

65,000 ft., 1¼-in.	12 cts. per ft.
42,000 ft., 1⅛-in.	11 " "
13,000 ft., 1⅛-in.	14 " "
1½-in.	13 " "
2-in.	18 " "
2½-in.	24 " "

In addition to the above we have all sizes of cable ranging from ⅝-in. up.

GENERAL SUPPLIES

Our stock includes such items as WIRE, WIRE ROPE, WIRE NAILS, CUT NAILS, HARDWARE OF ALL KINDS, AXES, PLUMBING MATERIAL, SHAFTING, HANGERS, PULLEYS, TWINE, CORD, ETC., ETC.

MACHINERY

Our Stock of Machinery is the largest to be found anywhere. We always have anything in the way of ENGINES, BOILERS, PUMPS, COMPRESSORS, FEED-WATER HEATERS, ETC., ETC. We issue a MACHINERY LIST.

Ask for Catalogue 258

CHICAGO HOUSE WRECKING CO.
West 35th and Iron Sts., Chicago

FOR SALE.

One Second-hand

BLAKE CRUSHER

9 x 15, in good condition.

Apply to
THE WILSON & BAILLIE MFG. COMPANY
26-2t 26 Court Street, Brooklyn, N. Y.

FOR SALE

Now in our Jersey City warehouses, 19 Hoisting Engines, new and second-hand; 21 Portable Locomotive Boilers; all sizes Horizontal Tubular Boilers; 39 Vertical Boilers, 5 to 200 HP.; 11 Corliss Engines; from 50 to 1000 HP. Pumps, all makes and sizes, from small boiler feeds to pumping Engines. Automatic Engines up to 1000 HP. Slide Valve Engines up to 250 HP. We also have Lathes, Planers, Drill Presses, Hammers, Power Presses, etc., in variety.

WICKES BROS.
95 Liberty Street, New York City

FOR SALE

Space under this head is sold at the uniform rate of $1.50 an inch; minimum charge, $1.50 a week.

New York Elevated Railroad Locomotives

Ready for immediate delivery. Excellent condition; 4 ft. 8½ in. gage; Forney type; cylinders 11 x 16-in., 12 x 16-in.; suitable for contractors, switching, etc.

BENJAMIN WATSON
66-70 Beaver St., New York City tf
Steel Rails, Cars, Locomotives, R. R. Supplies

Steam Shovels FOR SALE

Bucyrus, 65-ton, three years old.
Vulcan, 55-ton, 1¾-yd. dipper; almost new.
Bucyrus, 50-ton, 1½-yd. dipper; 1st-class order
Bucyrus, 55-ton, 2-yd. dipper; 1st-class order.
Marion A, 1½-yd. dipper; good order.
1¼-yd. Marion A shovel; 1st-class condition.
Vulcan, 45-ton—3 sets engines—1½-yd. dipper; built 1902; first-class order.
Bucyrus, 2-yd. dipper; good order.
Industrial, 65-ton shovel; fine order.
Vulcan—Giant D—crowding engines, 1½-yd. dipper; built 1901; first-class order.
Vulcan, Little Giant, crane-type, 30-ton, 1½-yd. dipper; almost new.
Vulc'n Little G. 8p, 1¼-yd. dipper; nearly new
Vulcan Little Giant, 25-ton, 1¼-yd.; rebuilt and in first-class order.
2 Vulcan Little G's, 25 tons, 1¼-yd.; good.
Vulcan Baby Giant, ¾-yd. dipper, crowding engines; fine order.

We have Locomotives and Cars for Contractors' use; write for prices.

THE MALES CO. 256 Broadway NEW YORK
713 Traction Bldg., Cincinnati, O.

1000 Bridges

24-tf **SPROUL & GREEN**
Civil Engineers
1947 Broadway, NEW YORK

FOR SALE.
10-TON AVELING & PORTER
Steam Road Roller
Just Finished Work—WILL GO CHEAP.
BOLTON G. COON,
27-2t KINGSTON, PA.

4-in. Second-Hand Pipe For Sale Cheap.

50,000 ft. 4-in. light-weight pipe or casing with threads and couplings.
20,000 ft. 4-in. same as above with flanges.
All in A1 condition and absolutely as serviceable as new pipe. We will sell same at very low price in car load lots. For further information address,
27-4t **F. E. PFANMUELLER & CO.**
177-181 East Division Street, Chicago, Ill.

The Entire Equipment for Industrial Railways

CARS, RAILS
PORTABLE TRACK
SWITCHES

Everything

For Sale and in Stock for Immediate Shipment
New 8, 12, 16 and 20-lb. Steel Tee Rails and Joints

FURTHER INFORMATION SENT PROMPTLY

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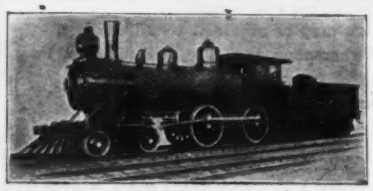
29 BROADWAY, NEW YORK



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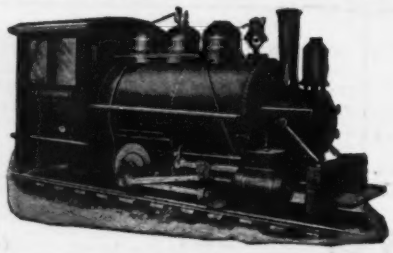
50-Ton
Standard Gauge
New firebox, flues, three-inch tires, and asbestos lagging.
IMMEDIATE DELIVERY

Flat Cars — Drop and Hopper Bottom Gondolas
50,000-lb. capacity. Entirely rebuilt. Immediate delivery.

New York — FITZ-HUGH, LUTHER CO. — Chicago
527 North Second Street, St. Louis 903 Rialto Building, San Francisco

THE DAVENPORT



Light Locomotives of any gage for Contractors, Mills, Plantations, Logging and Furnaces.
BUILT BY
Davenport Machine Works
DAVENPORT, IOWA
PROMPT DELIVERY

LIGHT STEEL RAILS—All Sections

A. F. BAUMGARTEN & BRO. Pittsburgh, Pa., Sole Agents
UNION RAIL COMPANY
Mills, Huntington, W. Va.

New Light Steel Rails

FOR SALE.
IMMEDIATE SHIPMENT
16, 20, 25, 30 and 35-lb. Steel "T" RAILS
with complete joints
CLEARFIELD STEEL & IRON CO.
MILLS AT CLEARFIELD, PA.
Offices,
German National Bank Bldg., Pittsburgh, Pa.

FOR SALE—We own a choice lot of 25-lb. and 30-lb.
RELAYING STEEL RAILS
and Splice Bars and Spikes for same. Also a number of Frogs, and Stub and Split
SWITCHES
If you want New or Relaying Rails, any weight, R. R. Spikes or Switches, write us.

ROBINSON & ORR,
419 Wood Street, PITTSBURGH, PA.

Contractors' Equipment FOR SALE OR RENT

STEAM SHOVELS.
Two 50-ton 1½-yd. capacity, latest improved type.
One "Baby" Giant Traction, with crowding engines.

LOCOMOTIVES
One 9 x 14, 36" gage saddle-tank Locomotive.
One 8 x 16, 36" gage saddle-tank Locomotive.

W. J. CARLIN COMPANY
34th St. & A. V. R. R., Pittsburg, Pa.

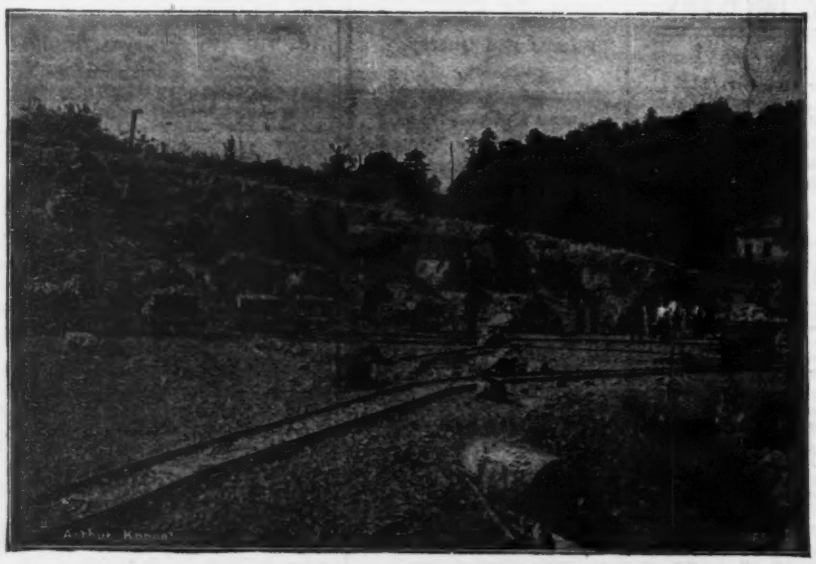
FOR SALE Advertisements That Bring *Results*

THE Manager of a Company that advertised railway equipment for sale in *one* issue of ENGINEERING NEWS wrote to the Secretary of the same Company that the last, and in fact their first, "For Sale" advertisement with us, had **"brought quite a few inquiries."** A small "For Sale" advertisement in two or three issues will likely bring **quite a few sales.** The cost is only $1.50 an inch.

Keep at least a one-inch "For Sale" advertisement always before our readers.

Industrial Railway Equipment

Cars, Rails, Switches, Locomotives
FRANK DAVIES 19-12t
68 BROAD STREET, - NEW YORK



Portable Track and Dump Cars used in a large lime-stone quarry on the Hudson River.

We plan, build and equip
Complete Industrial Railways

for Engineering Works, Contractors, Quarries, Factories, Foundries, Mines, Plantations, Boiler Rooms in Power Plants. etc.

Permanent or Portable Track, Rails, Switches, Crossings, Turntables, Wheels and Axles, Axle Boxes, all kinds of Wooden and Steel Cars.

We also furnish complete track layouts in sections of required lengths ready to be laid down.

A Large Stock Always Carried on Hand

Our long experience and large works guarantee best workmanship and construction.

Arthur Koppel

Manufacturer of Railway Material
Department F, 66-68 Broad Street, New York
Catalogue No. 20 sent on request.

Power and Mining Machinery Company

FORMERLY

Loomis-Pettibone Gas Machinery Company

AND SUCCESSOR TO

The Holthoff Machinery Co.

MANUFACTURERS OF

American Crossley Gas Engines
Loomis-Pettibone Gas Apparatus
Holthoff Mining Machinery

52-54 WILLIAM STREET, NEW YORK

Boston Office, State Mutual Building **Chicago Office, First National Bank Building**
Pittsburg Office, Farmers' Bank Building

FOR SALE

Space under this head is sold at the uniform rate of $1.50 an inch; minimum charge, $1.50 a week . . .

BOILERS

Horizontal Return Tubular.

5 66"x16'-100 HP. 2 60"x15'-75 HP.
3 60"x14'- 70 HP. 48"x12'-40 HP.
44"x10'- 30 HP. 42"x10'-25 HP.

PORTABLE BOILERS

125 HP. 60 HP. 3 50 HP.
40 HP. 35 HP. 30 HP.
25 HP. 15 HP.
2 25 HP. on wheels with engines.

VERTICAL BOILERS

48"x9'-40 HP. 42"x9½'-35 HP.
36"x8'-20 HP. 36"x7' -18 HP.
2 30"x7'-12 HP. 2 30"x6' -10 HP.
And smaller Steam Engines, Plain Slide Valve and Automatic.

A LARGE STOCK ALWAYS ON HAND.

Carlin Machinery & Supply Co.
Lacock and Sandusky Sts., Allegheny, Pa.

IF you contemplate engaging additional help, we suggest that you insert a card on our "Want" page under the heading

SITUATIONS OPEN

The cost is only 1½ cts. a word an insertion, and the results, we think, will be satisfactory.

The Engineering News Publishing Co.

FOR SALE

See first column for rates

PARTIAL LIST OF

Contractors' Material

ON HAND

One Marion Style "A" Shovel, with 1¼ to 1¾-yd. dipper.
One Vulcan Giant B, with 1¾-yd. dipper.
12 5-yd. standard gauge Western Wheeled Dump Cars.
4 5-yd. standard gauge Buda Wheeled Dump Cars.
1 Smith Concrete Mixer on skids, steam engine attached.
1 Pile Driver, 1 Flory Engine and Boiler, 4 Slips.
1 Orange Peel Dredge, complete, with 2 1¼-yd. Buckets.
1 35-HP. Horizontal Boiler on wheels; 1 20-HP. Upright Boiler.
1 4-in. and 1 8-in. Morris Centrifugal Pumps and connections.
1 3-in. and 1 4-in. Snow Pumps and connections.
1 Marine Pump and Hose; 1 Force Pump with pipe and hose.
9 No. 2 Western Wheeled Scrapers; 1 12 arc light Dynamo.
1,000 ft. 2-inch Iron Pipe with connections.

PLEASE NOTE,—We will **rent** you a complete **Contractor's Plant** if you do not wish to purchase as we have them always on hand ready to go out on short notice.

Yards and Shops, Newark, N. J.

Harper Machinery Company
Park Row Building, New York

THE HARMAN-COGGER CO., BLOOMSBURG, PA.
ENGINEERS, FOUNDERS and MACHINISTS

Builders of **SPECIAL MACHINERY**
LIGHT AND HEAVY

GRAY IRON CASTINGS

IN THE ROUGH and MACHINE FINISHED
COLUMNS AND STRUCTURAL CASTINGS
MINING MACHINERY AND MINE CARS

W. H. VON MENGERINGHAUSEN, M. E., Mgr. W. E. HARTMAN, Supt.

Estab. 1891 FOR THE YEAR BEGINNING NOV. 1st, 1903 Issued Annually

THE THIRTEENTH ANNUAL EDITION OF

Hendricks' Commercial Register

OF THE UNITED STATES

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OVER 1,300 PAGES **Is Now Ready for Delivery** OVER 12,000 CLASSIFICATIONS

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In fact the work gives the name and address of the Manufacturers of **everything** made from **Iron, Steel, Brass, Bronze, Aluminum, Clay, Stone, Marble, Granite, Slate, Wood, Fibre, Asphalt, Asbestos,** etc. Including the **Professions that Specify;** the **Dealer** who handles; the **Manufacturers** and **Contractors** who are consumers. This gives you in a **Nutshell** the contents of our Directory. **Over 1,300 Pages,** bound in cloth, and forwarded to any part of the country, expressage prepaid, on receipt of **Price, $6.00**

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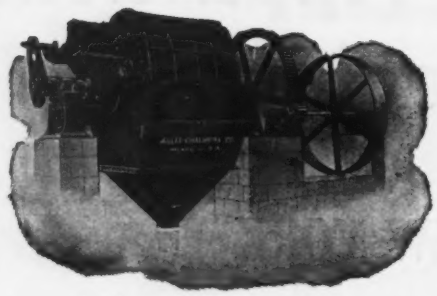

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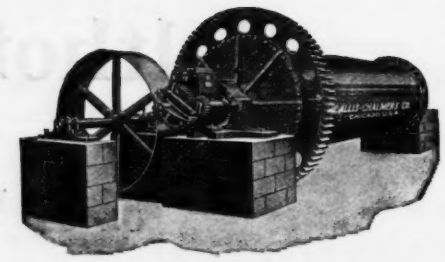

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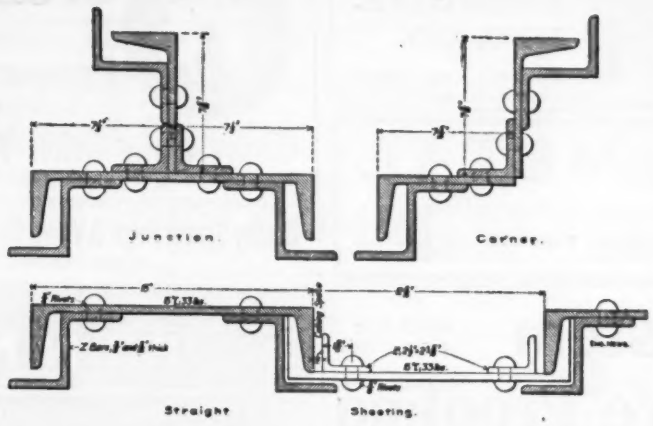

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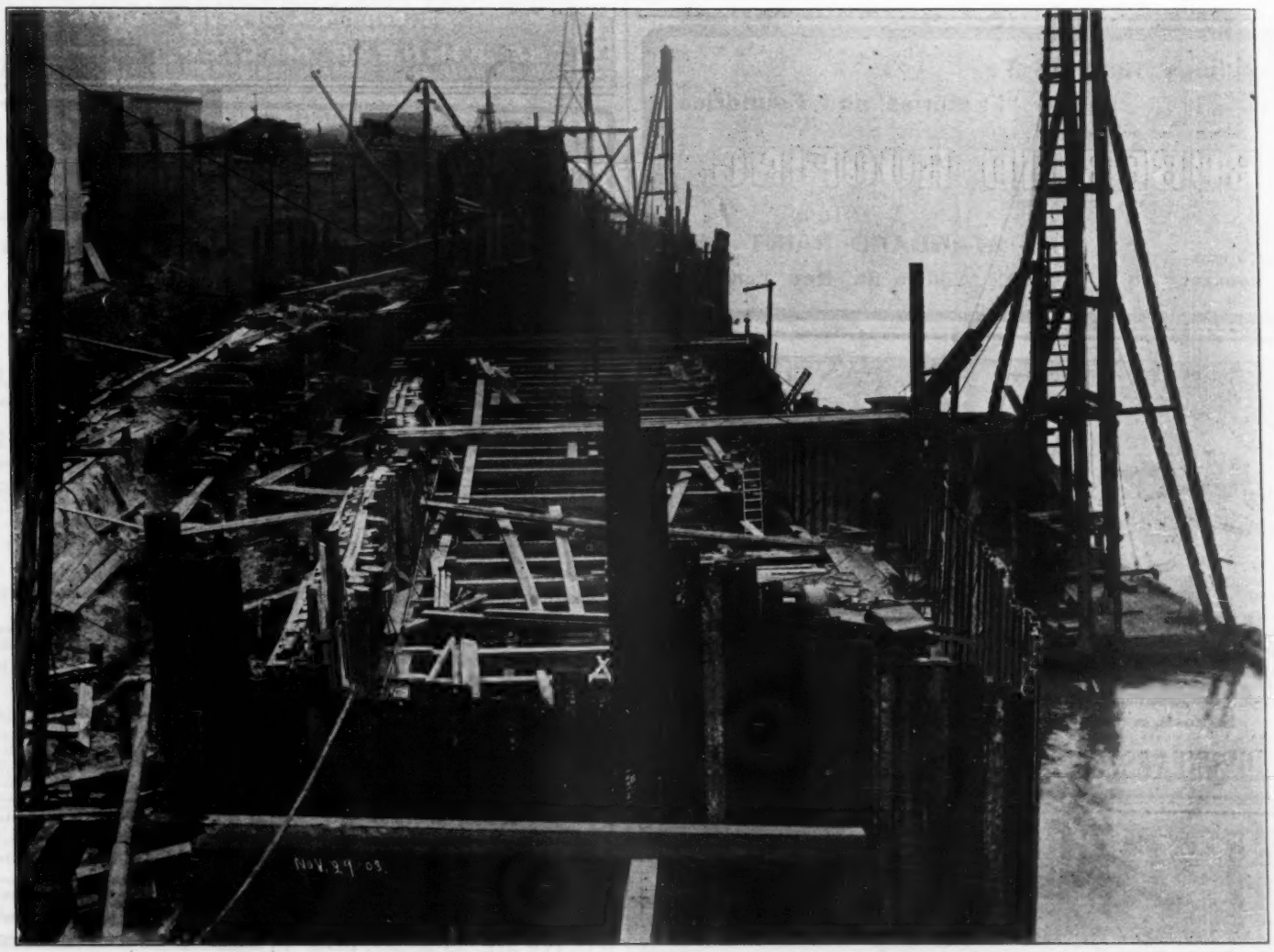

View of Cofferdam constructed by Union Electric Light & Power Co., at St. Louis, on Mississippi River, looking North from south end of Cofferdam. Size 40 ft. x 360 ft. x 50 ft. deep.

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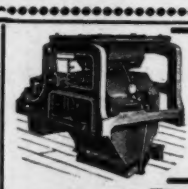

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OF ANY CAPACITY.

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IRON CASTINGS

Board of Trustees,
"Commissioners of Water-works,"
Cincinnati, O.

PROPOSALS for Furnishing and Delivering Iron Castings for the Counterbalance Weight in the Pump Pit of the Eastern Pumping Station, near the Village of California, in Hamilton County, O.

Sealed proposals will be received at the office of the Board of Trustees, "Commissioners of Water-works," of the City of Cincinnati, Ohio, until 12 o'clock noon of Friday, Jan. 8, 1904, for the manufacture, furnishing and delivery of Iron Castings for the Counterbalance Weight in the Pump Pit of the Eastern Pumping Station, near the Village of California, in Hamilton County, Ohio, in accordance with plans, specifications, and detail drawings on file in the office of the Chief Engineer of the Board of Trustees, "Commissioners of Water-works."

The same to be paid for as stipulated in the form of contract for the performance of the above work, and which form of contract is on file in the office of the Board of Trustees, "Cmmissioners of Water-works."

Plans and detailed drawings of the castings, and copies of the specifications, estimated quantity of the castings to be furnished, form of proposal, forms of bonds, and form of contract, can be secured at the office of the Chief Engineer of the Board of Trustees, "Commissioners of Water-works."

Bidders must enclose their bids in sealed envelopes, and deposit the same with the Clerk of the Board of Trustees, "Commissioners of Water-works," before Friday, the 8th day of January, 1904, at 12 o'clock m., and such sealed envelopes must have endorsed thereon the nature of the bid and the name and address of the bidder.

Bids will be opened on Friday, the 8th day of January, 1904, at 12 o'clock m., at the office of the Board of Trustees, "Commissioners of Water-works."

Each bid shall be accompanied with a bond in the sum of $5,000, and signed by two sureties, for the acceptance of the contract, if awarded by the Board of Trustees, "Commissioners of Water-works"; or the bidder may deposit with the Board of Trustees, "Commissioners of Water-works," in lieu of such bond, a certified check or bank certificate of deposit, payable to the order of the Board of Trustees, "Commissioners of Water-Works," or cash equal in amount to the bond as above required.

Bidders must furnish satisfactory evidence of their ability to do the class of work required.

Bidders must use the printed forms, as none other will be received.

The Board of Trustees, "Commissioners of Water-works," reserve the right to reject any and all bids.

By direction of the Board of Trustees, "Commissioners of Water-works."

AUG. HERRMANN, President.
CHARLES G. ROTH, Clerk. 25-3t

DEPARTMENT OF THE INTERIOR, Washington, D.C., Nov. 25, 1903.—Sealed proposals, in duplicate, will be received at the Department until 12 o'clock m., Monday, Jan. 4, 1904, for furnishing 1,000 barrels or more of first-class Portland cement, delivered at Globe, Ariz. Bidders will also state price at which they will furnish one carload only of such cement. No bids will be received except from manufacturers or their authorized agents. Specifications may be obtained upon application to Arthur P. Davis, Supervising Engineer, Phoenix, Ariz. All bids must be accompanied by a certified check for $200, payable to the order of the Secretary of the Interior. The right is reserved to reject any and all bids, waive technical defects, to accept one part and reject the other, as the interests of the service may require. Proposals must be addressed to the Secretary of the Interior, marked "Proposals for Portland Cement for Salt River, Ariz." Bidders are invited to be present at the opening. E. A. HITCHCOCK, Secretary. 23-5t

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ACHESON TRADE ELECTRIC FURNACE MARK GRAPHITE

Manufactured in the Electric Furnace. Write us for full information regarding the use of this material in high grade protective coatings.

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OFFICE OF THE CHIEF QUARTERMASTER, Department of Texas, San Antonio, Tex., Dec. 21, 1903.—Sealed proposals, in triplicate, for erection of a 50,000 gallon Steel Tank on 50-ft. trestle at Fort Brown, Tex., will be received here and at the Office of Quartermaster, Fort Brown, Tex., until 11 o'clock a. m., Jan. 5, 1904. U. S. reserves the right to reject any or all bids. Information furnished on application. Proposals for tank and trestle, other than specified, will be considered, if accompanied by detailed drawings and specifications. Envelopes containing proposals should be marked "Proposals for Steel Tank and Trestle at Fort Brown," and addressed to the undersigned or to Quartermaster, Fort Brown, Tex. T. E. TRUE, C. Q. M. 26-2t

J. G. FALCON
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Pipe Laying Under Water a Specialty.
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Sewerage, Paving and Water Supply

Santiago, Chile

The Government of Chile will ask for public bids, which will be opened at Santiago, Chile, on the

First of July Next

for the sewerage, pavement and increase of the water supply of that city.

Persons desiring information regarding this work may obtain it by the end of January at the Chilean Legation in Washington, D.C., or at the Chilean Consulate General in New York, 135 West 11th Street. 27-5t

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SEWERS, CAST-IRON PIPE, HYDRANTS AND VALVES.

Office of the Sewerage and Water Board,
602 Carondelet St.,
New Orleans, La., Nov. 20, 1903.

Sealed proposals will be received until 12 m. Tuesday, Feb. 2d, 1904, for the construction of approximately 66 miles of Sewers and appurtenances and the laying of 2.7 miles of Water Mains.

The Sewers will range in size from 8 ins. to 27 ins., and in depth from 5 ft. to 16 ft., and will include 700 manholes and 300 flush-tanks.

The water mains will be in sizes from 6 to 16 ins., and the laying of these water mains will be included in one of the sewer contracts.

Bids will also be received on one contract for furnishing f. o. b. cars New Orleans, approximately 2,600 tons of cast-iron pipe, 113 tons of special castings, and 36 gate valves, in sizes of pipe from 6 to 48 ins., and 24 hydrants. With bids on the contract for furnishing cast-iron pipe, valves and hydrants, a certified check for $1,200 must be deposited.

The sewer work will be divided in six contracts, and certified checks ranging from $1,000 on the smallest to $2,500 on the largest contract, must be deposited, and deposits required must be made prior to the submission of their bids by contractors bidding on any contract.

A surety company bond for an amount equal to 25% of the gross amount of each contract will be required of the successful bidder in each case.

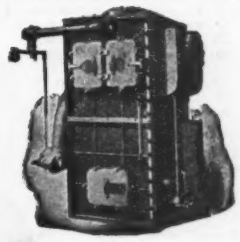
After Dec. 20, 1903, specifications, general plans and blank forms of proposals may be obtained at the office of the Board, and plans and specifications can also be seen at the office of Hering & Fuller, Consulting Engineers, 170 Broadway, New York.

The right is reserved to reject all bids.

F. S. SHIELDS, Secretary.
GEO. G. EARL, General Supt. 23-9t

U. S. ENGINEER OFFICE, Vicksburg, Miss., Dec. 22, 1903.—Sealed proposals for building Locks and Dams Nos. 4 and 6, Ouachita River, Ark. and La., will be received here until 11 a. m., Jan. 22, 1904, and then publicly opened. Information furnished on application. CHAS. S. BROMWELL, Capt., Engrs. 26-4t

COCHRANE



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A COCHRANE FEED WATER HEATER (which is of the "open" type—the exhaust steam and cold water being brought together in the heater) will use less exhaust steam and less fresh cold water for supplying boiling hot water for boilers of a given horse power than will be required by any form of "closed" or "pressure" heater. There is, therefore, a positive and considerable saving to be made through the use of a Cochrane Heater where the available exhaust is limited, or where the feed supply is bad or scarce. This is a fact which we will be glad to substantiate if you are not acquainted with the reasons why.

More than that, the efficiency of a Cochrane Heater is not impaired through the heater's being fouled by the impurities which it takes out of the water. But the heating capacity of a closed heater is impaired just in proportion to the purification which it gives, for the impurities taken out of the water build up a coating of scale on one side of the tubes or coils, and on the other side the exhaust deposits a coating of oil. Both of these coatings hinder the transmission of the heat.

Now to you the next most important consideration is the question of cost—that is, do these Cochrane Heaters cost more or much more than closed heaters?

Generally they cost less, except for the smallest sizes.

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HARRISON SAFETY BOILER WORKS
3166 N. 17th St., Philadelphia, Pa.
Manufacturers of the Sorge-Cochrane System and of the Cochrane Steam and Oil Separators.

For other Proposal advertisements see page 393 of the Supplement, and pages XXI., XXXII. and XXXIIa of Advertisements.

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KEYSTONE DROP FORGE WORKS,

CHESTER, PENNA., U. S. A.

PROPOSALS will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D.C., until 12 o'clock noon, Jan. 19, 1904, and publicly opened immediately thereafter, for the construction of buildings for the accommodation of the U. S. Naval Hospital, Washington, D.C., on the grounds belonging to the U. S. Naval Museum of Hygiene. Plans can be obtained from the architect, Mr. Ernest Flagg, 35 Wall St., New York, N. Y., upon deposit of fifteen (15) dollars, ten (10) dollars of which will be refunded upon return of plans. Specifications and blank proposals can be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington, D.C. H. T. B. HARRIS, Paymaster-General, U. S. Navy. 26-2t

DEPARTMENT OF THE INTERIOR.—Washington, D. C., Dec. 7, 1903.—Notice is hereby given that the time for opening proposals for the construction of about 18 miles of Canal, Pressure Pipes, and Tunnels, together with head-works, spillways and gates for the diversion and conduction of about 200 cu. ft. of water per second, from Salt River, about 25 miles north of Globe, Ariz., for power purposes,has been postponed from Dec. 8, 1903, until 12 m. Thursday, Jan. 7, 1904. All the bids will be opened at the office of the Secretary of the Interior. E. A. HITCHCOCK, Secretary. 24-5t

ASPHALT AND BRICK PAVING.

Belleville, Ill.

The Board of Local Improvements of the City of Belleville, Ill., will receive bids and let contracts for Paving with brick and setting stone curbing on Jan. 20, 1904, for West Main St., and South Illinois St.; also for Paving with asphalt and constructing combined granitoid curb and gutter on Race St., 2d and 3d Sts. Plans and specifications can be seen at the office of the City Clerk of Belleville, Ill. Official advertisement will appear in the "Belleville Daily Advocate."

FRED J. KERN,
President B. L. I.

26-4t

CONDUITS LAID FOR ANY PURPOSE IN ANY PLACE

O. M. OEST, 277 Broadway, New York
CINCINNATI, OHIO.

PROPOSALS FOR REPAIRING AND REBUILDING WHARF.—Office of the Constructing Quartermaster, Fort Totten, Willets Point, N. Y., Dec. 16, 1903.—Sealed proposals for repairing and partial rebuilding of Quartermaster's Wharf at this post will be received here until 12 m., Jan. 6, 1904, and then opened. Bidders must state the time in which they will complete the work. Information furnished on application. Envelopes containing proposals should be endorsed "Proposals for Repairing and Rebuilding Wharf, Fort Totten, N. Y.," and addressed to Capt. G. H. McMANUS, Constructing Quartermaster.25-3t

AIR LIFT.

Ithaca, N.Y., Dec. 17, 1903.

Sealed proposals for furnishing and installing an Air Lift, and for the work and materials for connecting the artesian wells to the intake well at the pumping station, near the Cayuga Inlet in the City of Ithaca, N. Y., will be received by the undersigned at his office in the City of Ithaca, N. Y., on or before the 4th day of January, 1904, at 7:30 p. m. Plans and specifications can be seen at the City Hall in said city. All bids to be accompanied by a certified check for $500 payable to the Ithaca Water Board. The said Board reserves the right to reject any and all bids.

By order of the Ithaca Water Board.

JOHN MILLER,
Secretary.

26-2t

SEALED PROPOSALS will be received at the office of the Light-House Engineer, Mobile, Ala., until 12 o'clock m., Jan. 7, 1904, and then opened, for furnishing all materials and labor necessary for constructing and erecting Beacons to mark the dredged channel leading up to Gulfport, Miss., in accordance with specifications, copies of which, with blank proposals and other information, may be had upon application to CAPT. W. E. CRAIGHILL, Corps of Engineers, U.S.A., Engineer. 24-4t

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Brass Melting FURNACES for Use with Oil as Fuel.

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for Melting, Heating, Annealing, Tempering.

FURNACES for fine heats, such as tempering, drawing and bluing...

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SIZES, 2-in. to 36-in.

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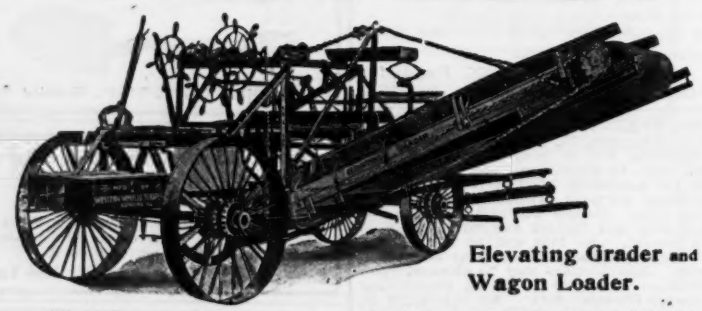
TENTS

"WESTERN"



Elevating Grader and Wagon Loader.

Nearly every contract has some work which can best be done with this machine. And when within its range, the saving by its use is very large. Can you afford to run your outfit without a Western Grader? As a wagon-loader, should be used on hauls between wheeled scraper hauls and car hauls.

DUMP WAGON.
Low. Strong. Quick in Operation.

Note the bracing of front gear. High arched hind axle. Wide opening for discharge of load. Wood axle and steel skeins, if preferred.

Scrapers, Plows, Dump Cars, Carts.

ASK FOR CATALOGUE.

WESTERN WHEELED SCRAPER COMPANY

AURORA, ILLINOIS.

For other Proposal advertisements see page 393 of the Supplement, and pages XXI., XXXII. and XXXIIa of Advertisements.

The EDISON PORTLAND CEMENT Co.

85 PER CENT.
THROUGH **200** MESH
IT WILL DO BETTER

NEW VILLAGE, N. J.

(Operating under the Patents of Thomas A. Edison)

TRADE Thomas A. Edison MARK

Manufacturers of the most reliable and finest ground cement on the market.
Concrete made with this cement will be very much stronger than from any other cement, domestic or foreign.

SALES OFFICES: PHILADELPHIA, 600 Girard Trust Building; NEW YORK, 1309 Empire Building; PITTSBURG, 2001 Farmers' Bank Building; BOSTON, 414 Board of Trade Building

WATER-WORKS AND SEWERS.

Hawkinsville, Ga.

Sealed proposals will be received at the Council Chamber in the City of Hawkinsville, Ga., until noon of the 21st day of January, 1904, for the following items of a System of Water-Works and Sewers:

One or more Artesian Wells, 6 or 8 ins. diameter, 300 to 400 ft. deep.
One Brick Pumping Station.
Two 500,000 gallon Duplex Pumping Engines, one high-pressure, one compound.
Two 70-HP. Boilers.
One Boiler Feed Pump, One Heater, with Fixtures and Fittings.
Furnishing and erecting one Steel Tank and Tower of 100,000 gallons capacity, 100 ft. to top of tank.
Furnishing 430 short tons Cast-Iron Water Pipe.
23,000 lbs. Special Castings.
48 Hydrants, 40 Gate Valves and Boxes.
Laying about 23,000 lin. ft. of 4-in. and 10-in. Pipe, and setting 48 Hydrants.

At the same time and place, sealed proposals will also be received for furnishing 19,500 ft. of 6-in. to 15-in. Sewer Pipe, bids for laying the same, and constructing 30 manholes and 10 flushtanks.

A certified check equal to 5% of the amount of the bid must accompany each proposal. A satisfactory bond will be required of the successful bidder. The City reserves the right to reject any or all bids.

Plans are on file and specifications can be obtained at the office of the City Clerk, and at the office of Arthur Pew, Engineer.

T. J. HOLDEN,
26-4t City Clerk.

STEEL BELL TOWER.

Bradford, Pa.

Bids will be received Jan. 18, 1904, for steel bell tower. Certified check, $200. Write City Engineer for plans and specifications. Address bids to City Clerk. 26-3t

E. C. CHARLTON, City Clerk.

U. S. ENGINEER OFFICE, 2001 I St., N. W., Washington, D. C., Dec. 5, 1903.—Sealed proposals for Dredging in Rappahannock River, Milford Haven, and Carter's Creek, Va., will be received here until 12 o'clock noon, Jan. 5, 1904, and then publicly opened. Information furnished on application. CHAS. J. ALLEN, Lieut.-Col., Engrs. 24-4t

STEEL SUPERSTRUCTURE FOR CAMBRIDGE BRIDGE.

Cambridge Bridge Commission,
Boston, Dec. 5, 1903.

Sealed bids for building the Steel Superstructure for Cambridge Bridge, will be received by the Cambridge Bridge Commission at the Mayor's Office, City Hall, Boston, until 12 m. SATURDAY, Jan. 16th, 1904, and at that time and place will be publicly opened and read.

Each bid must be accompanied by a properly certified check for the sum of ten thousand dollars, payable to the order of the Cambridge Bridge Commission, said check to be returned to the bidder unless he fails to execute the contract, should it be awarded to him, a surety company bond in the sum of two hundred thousand ($200,000) dollars for faithfully doing the work will be required.

Notice to contractors, forms of bid, contract, specifications and bond, can be obtained, and plans can be seen at the office of the City Engineer, City Hall, Boston.

The Commission reserves the right to reject any and all bids should it deem it advisable to do so, and reserves the right to award the contract as it deems best.

PATRICK A. COLLINS,
JOHN H. H. McNAMEE,
E. D. LEAVITT,
Cambridge Bridge Commission.
WILLIAM JACKSON, Chief Engineer. 26-4t

DRY DOCK AT ST. JOHN, N. B.

The Imperial Dry-Dock Co.
of St. John, N.B., Can.,
St. John, N.B., Nov. 30, 1903.

TENDER FOR THE CONSTRUCTION OF A DRY-DOCK AT ST. JOHN, N.B.

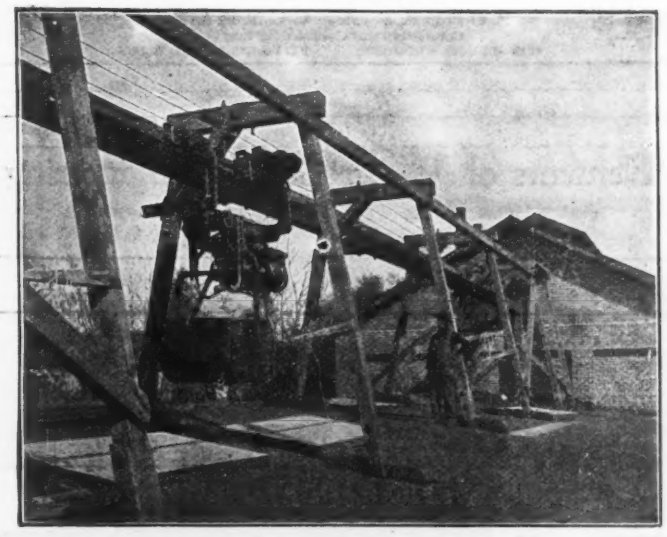
Tenders sealed and endorsed "Tender for The St. John Dry-Dock" will be received up to 5 o'clock p. m., on Wednesday, the 3d day of February, 1904, at the office of The Imperial Dry-Dock Company, 3 Water St., St. John, N. B., for the construction of a Dry-Dock and other works in accordance with plans and specifications which can be seen at the office of the company, 3 Water St., St. John, N. B., on or after Monday, 7th December. Blank forms of tender can be obtained by application to the Secretary of the Company.

The Board of Directors reserve the right to reject any or all of the tenders received.

SAMUEL A. CORBITT,
24-5t Secretary-Treasurer.

TELPHERAGE

Is the Handling of Material by Electricity



TYPE OF A SIMPLE WOODEN A-BENT. T-RAIL ON WOODEN STRINGER. OPENINGS IN ROOF OF COAL SHED COVERED.

This illustrates the single motor Telpher, the Trailer, the swinging downcomes, the Electric Hoist, minimum headroom, one sheave type, and the Automatic Control. By moving a single switch, located at any convenient point, the Telpher is started, stopped and reversed, and the same is also true of the raising and lowering by means of the Electric Hoist; all that the operator has to do is to move the switch. At the end of the line, dead sections stop or reverse the Telpher. Such lines, with the Electric Hoists, are independent of distances and curves. The opening in the roof of coal shed is uncovered for receiving the coal.

For latest circulars up to No. 44, address

United Telpherage Company

20-22 Broad Street New York City, U. S. A.

WORKERS IN CONCRETE

Gateway of an informal Garden in Brookline, Mass. Post caps of Aberthaw Cast Stone. Wall of rough picked concrete.

No construction quicker than Concrete, provided the builder knows his business. Grows stronger with age.

Anything in Concrete Designed and Built

ABERTHAW CONSTRUCTION CO.
8 Beacon St., Boston, Mass.

For other Proposal advertisements see page 393 of the Supplement, and pages XXI., XXXII. and XXXIIa of Advertisements.

FRANK B. GILBRETH, M. Am. Soc. M.E.
General Contractor

WE SOLICIT CONTRACTS WHERE IT IS DESIRED TO PLACE ALL BRANCHES OF THE ENTIRE PROJECT UNDER ONE CONTRACT, AND WHERE THE TIME FOR COMPLETION IS LIMITED. WE MAINTAIN A PERMANENT FORCE OF CIVIL, MECHANICAL AND CONCRETE ENGINEERS, AND THE LARGEST EQUIPMENT OF CONCRETE MACHINERY. WITH EXPERTS AT THE HEAD OF EACH DEPARTMENT, WE BELIEVE THAT WE ARE GIVING THE BEST RESULTS OBTAINABLE.

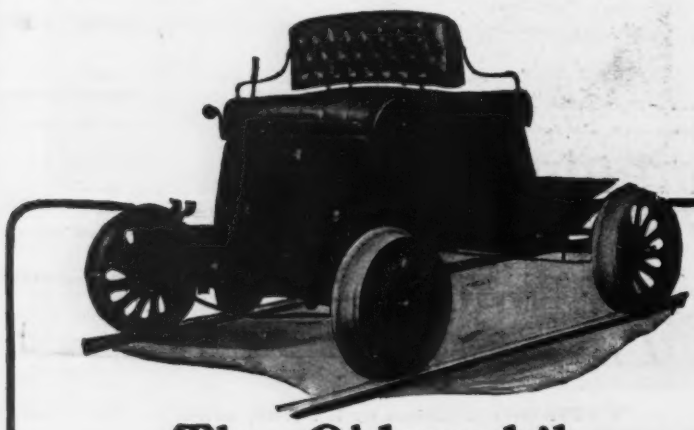
BOSTON NEW YORK LONDON

For Strength and Economy in Building Construction
Adopt the
Cummings
System of Reinforced Concrete
(Patents applied for)
ROBERT A. CUMMINGS
Consulting and Contracting Engineer
609 HOUSE BUILDING PITTSBURG, PA., U. S. A.

Elements of Water Supply Engineering

Cloth, 6 x 9 ins; 168 pp. Price, $2.00

By E. SHERMAN GOULD M. Am. Soc. C. E.



The Oldsmobile Railway Inspection Car

This model of the Oldsmobile adapted to track service allows the railroad man to forever dispense with back-breaking velocipedes that work by hand power. It is simplicity itself to operate, and the height of ease and comfort to ride in.

One filling of the gasoline and water tanks sends it whirling over the track for 100 miles. A speed of 40 miles an hour can be maintained on any ordinary grade.

It presents a handsome appearance. The body is finished in dark green and black, with nickeled trimmings. Seats and back upholstered in first quality leather.

Price, $450.00

The Oldsmobile Railway Inspection Car needs no further recommendation as to its mechanical excellence than to say that it is equipped with the same 4½ horse power gasoline engine that is used in the standard Oldsmobile Runabout.

This famous little car carried off first and second prizes in the recent English Reliability Runs in competition with the best light-weight cars in Europe and America.

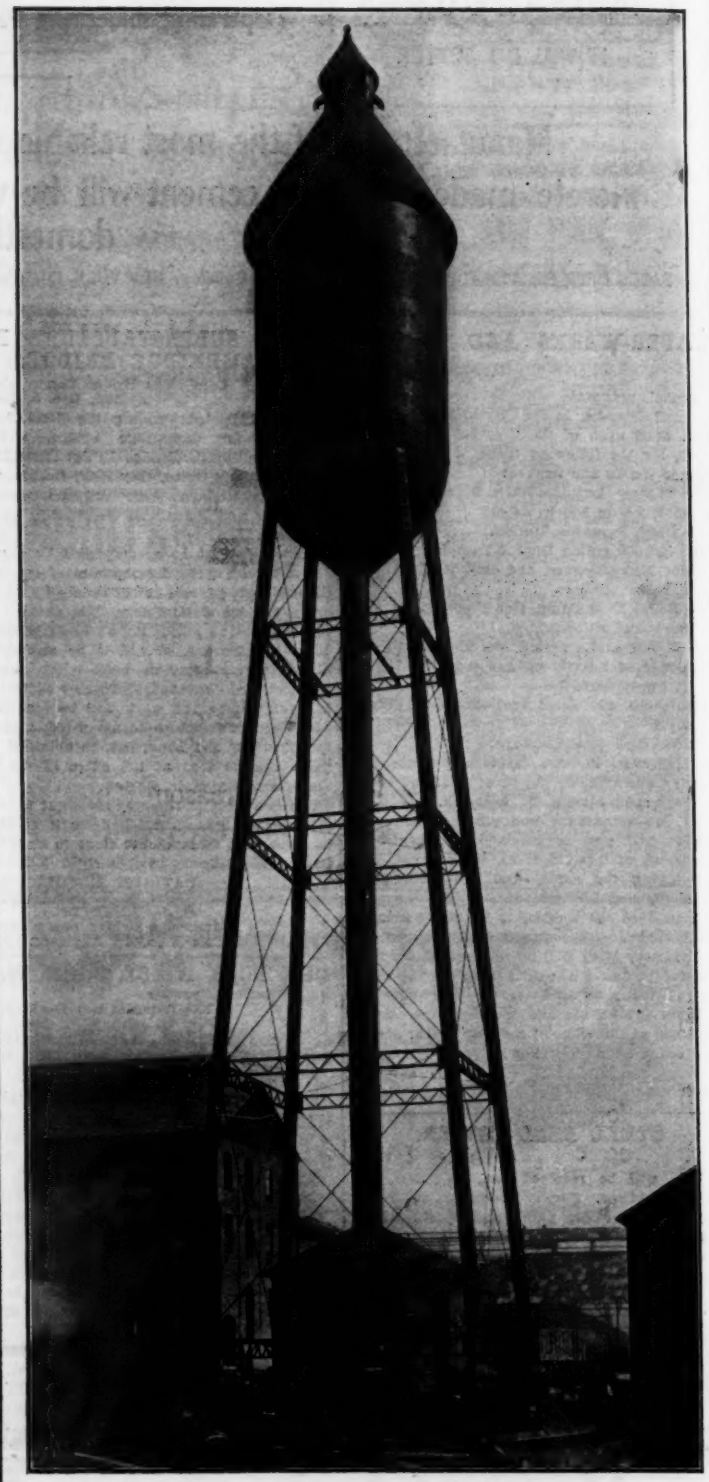
Standard Oldsmobile Runabout Price, $650.00

For complete information about either machine, see our selling agents in all principal cities, or write direct to Department 77.

OLDS MOTOR WORKS
DETROIT, U. S. A.

Member of the Association of Licensed Automobile Manufacturers

Steel Water Towers



This Water Tower and Tank was especially designed by us for the Lackawanna Steel Co., Buffalo, N. Y.
Capacity, 112,000 gals. Height, 158 ft.

We are prepared to manufacture and erect Steel Water Tanks of any size and height in any part of the world.

Write for Catalog.

Chicago Bridge & Iron Works
105TH AND THROOP STS.
CHICAGO, ILL.

Lythite

Cold Water Paint

for exterior and interior painting.

THE BEST MILL AND FACTORY WHITE

The whitest white made, won't flake or peel, a hard, firm sanitary surface, a fire retarder. Samples and proofs for the asking.

FRANK S. DE RONDE CO.
52 Cliff Street,
New York.

A Fundamental Blunder

is committed by whoever specifies or uses a corrosive oxide paint for the protection of steel or iron, and if you want to know the reason why, write to Toch Bros., 468-472 West Broadway, New York, who manufacture the

R. I. W. DAMP RESISTING PAINT

and various other good paints, and they will send you a scientific treatise on this subject which will interest you and which contains very profitable information. **Write to Us.** We will send you free of charge a pamphlet entitled the

"Chemistry of Paints and Raw Materials"

THE ZIBELL DAMP-RESISTING PAINT CO. 273 WATER ST. NEW YORK
MANUFACTURERS
WATER-PROOF PAINT Resists and Checks Moisture and Dampness on Brick and Frame Buildings, Inside and Outside, in any desired color.
PROTECTORINE kills Saltpetre and all other stains.
TRADE MARK TELEPHONE 1702 JOHN

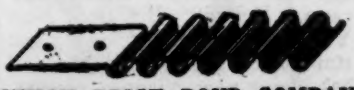
CHILTON BLACK BRIDGE PAINT
FOR RAILROADS
STRUCTURAL PAINT
69 Cortlandt Street, New York FOR STEEL AND IRON BUILDINGS

Carbonizing Coating

Manufactured only by THE COHEEN MFG. CO.
Also Manufacturers of CANTON, O., U. S. A.
GRAPHITE AND METALLIC PAINTS of all Characters

Paint for Structural Iron. Non-Porous; Acid and Alkali Proof
The only chemically combined Paint made.
When applied on new work Guaranteed for 10 years
SPECIAL CARE GIVEN TO RAILROAD SPECIFICATIONS

UNION BOND STEEL WALL TIES



ALL KINDS—GALVANIZED
For Face Brick, Veneering, Terra Cotta, Hollow Walls, etc.

UNION BRICK BOND COMPANY, Exclusive Mfrs., **PITTSBURG, PA.**

The Question of the Year

How to prevent the action of

ELECTROLYSIS

The Problem That Confronts Every Engineer and Electrician.

Use

Bituminized Fiber Conduit

The **Only** Conduit Sold With a Guarantee
It is Water, Gas and Electrolysis Proof.

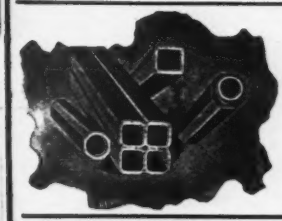
The Safeguard in the Construction of Underground Electric Light, Power, Telegraph, Telephone and Street Railway Systems

Are You Protected?

Send for Illustrated Catalogue

AMERICAN CONDUIT COMPANY

170 Broadway New York | 822 Manhattan Building Chicago | 336 Macy Street Los Angeles



FIELD CLAY CONDUITS

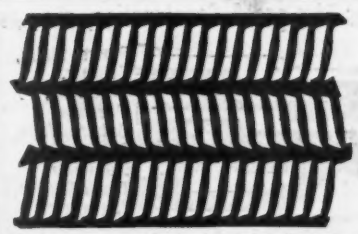
FACTORIES
BRAZIL, IND. PENNSYLVANIA
OHIO and NEW JERSEY

C. J. FIELD, 29 Broadway, New York
AGENTS
F. B. BADT & CO., Monadnock Block, Chicago
THE W. G. NAGEL ELECTRIC CO., Toledo, Ohio.

BROMLEY PATENT
FIRE-PROOF
Floor System

RIGHTS FOR SALE
Or placed on Royalty

FOR FULL PARTICULARS, WRITE
A. H. BROMLEY, Jr., 1925 Land Title Bldg., Philadelphia



THE DEMAND FOR METAL LATH IS BEST MET BY

Herringbone
Expanded Steel Lath

MANUFACTURED BY
THE GENERAL FIREPROOFING CO., Youngstown, Ohio

In Writing to Advertisers Please Mention ENGINEERING NEWS.

Engineers, Contractors, Managers

What do you want made of Plate or Sheet Metal?

Our thorough equipment insures prompt execution of special work, heavy or light. Send specifications and let us quote price.

General Plate and Sheet Steel Workers

The W. J. CLARK CO., Salem, Ohio

HENION & HUBBEL, Agents, 61-69 N. Jefferson St., CHICAGO, ILL.

Sole Mfrs. of the Lane Patent Joist-Hanger

Roof and Gallery of 61-foot Span College of Music, Cincinnati

L. J. MENSCH
CIVIL ENGINEER AND CONTRACTOR

Hennebique System
Armored Concrete
Construction

Structural Steel replaced by reinforced concrete for all purposes. Saving 15 to 30 per cent.

MONON BUILDING CHICAGO

ADHESION NOT NECESSARY WITH

CORRUGATED STEEL BARS

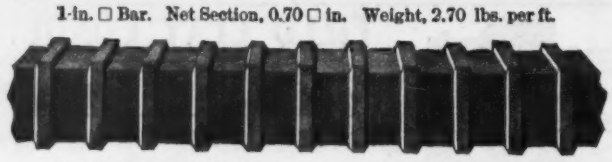
For Steel Concrete Construction

½-in. □ Bar. Net Section, 0.18 □ in. Weight, 0.64 lbs. per ft.

¾-in. □ Bar. Net Section, 0.37 □ in. Weight, 1.34 lbs. per ft.

⅞-in. □ Bar. Net Section, 0.55 □ in. Weight, 2.05 lbs. per ft.

1-in. □ Bar. Net Section, 0.70 □ in. Weight, 2.70 lbs. per ft.



1¼-in. □ Bar. Net Section, 1.07 □ in. Weight, 4.20 lbs. per ft.

These bars have an elastic limit of between 50,000 and 60,000 lbs. per sq. in.

Catalogues and designs furnished on application

St. Louis Expanded Metal Fireproofing Co.

A. L. JOHNSON (M. Am. Soc. C. E.), COMPANY ENGINEER.

General Agents **ST. LOUIS, U. S. A.**

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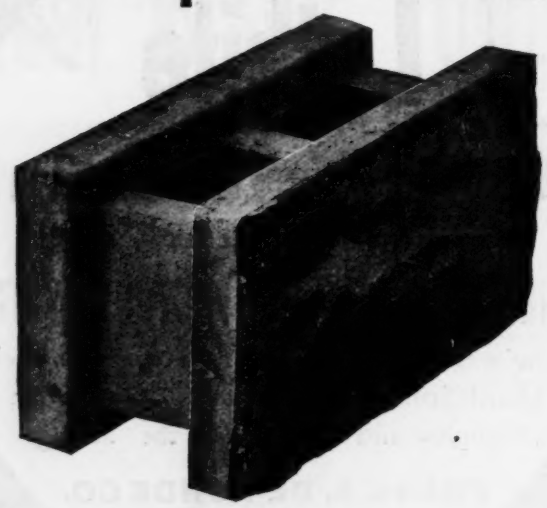
BUFFALO EXPANDED METAL CO., D. S. Morgan Bldg., Buffalo, N. Y.
T. L. CONDRON, M. Am. Soc. C. E., 1750 Monadnock Bldg., Chicago
JOHN HOWARD HERRICK, 504 Law Bldg., Baltimore, Md.
WESTERN EXPANDED METAL & FIREPROOFING CO., Rialto Bldg., San Francisco, Cal.

Our Purpose Has Been



To produce a device for the manufacture of

Hollow Cement Stone

in which the stone could be made of **"correct concrete"** instead of **a dry mixture of sand and cement** and which would produce a stone dense, hard and non-porous, of proper shape and size to be laid cheaply.

By **"correct concrete"** we mean concrete composed of **gravel or crushed stone, and sand, properly graded, to fill all voids, and made wet.**

RESULTS SHOW OUR SUCCESS

With the DYKEMA MOULD for HOLLOW CEMENT STONE

We save one half the cement **We save one-third the labor**

We are constructing buildings at less than one-half brick cost and less than wood
We make money at it—You can

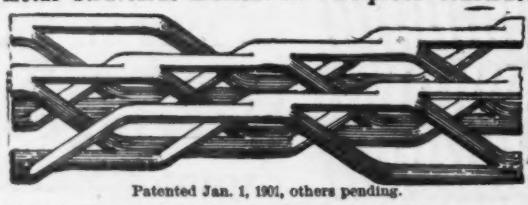
K. DYKEMA & SON

Booklet No. 6 tells more. **31 Fountain Street, Grand Rapids, Mich.**

Many of the most DESIRABLE ITEMS published each week in our Construction News supplement are furnished by the readers of Engineering News, and refer to work in which they are interested. We desire more of these special items, thus making our columns of Construction News and Industrial Notes of still greater interest and value. We ask you to send us such desirable items as you can.

STEEL CONCRETE

Best Concrete Binder and Self-Centering with Kuhne's Sheet Metal Structural Element for Fire-proof Construction, etc., as



Floors, Stairs, Ceilings, Partitions, Furrings, Outside Walls, Roofs, Sidewalks, Trunk Sewers, Tanks, etc.

Patented Jan. 1, 1901, others pending.

TRUSS METAL LATH CO., Mfrs., 15-25 Whitehall Street, N. Y.

CATALOGUES ON APPLICATION.

LOCK WOVEN STEEL FABRIC

FOR REENFORCING CONCRETE

Already used in

Penstock, 4,000 ft. by 8 ft. diam.,
Standpipe, 80 ft. high
Reduction Tanks,
Filter Beds,
Garbage Reduction Plants,
Eight Large Paper Manufacturing Plants,
Large Electric Power Plants
and
Two of New York's Largest and Finest Hotels.

A continuous Fabric of High Carbon Drawn Steel Thoroughly Galvanized

Is this what Engineers have been looking for?

It is laid from Wall to Wall without Splicing.

The **Strongest** **Safest** Most **Durable** and Most **Easily Applied**

W. N. WIGHT & CO., 160 Fifth Ave., New York

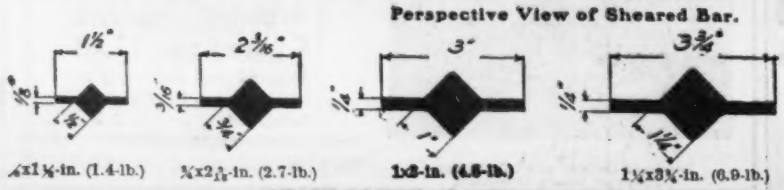
T. H. BROOKS & CO. CLEVELAND, O.

FLOOR & SIDEWALK LIGHTS.
OF EVERY DESCRIPTION.
SEND FOR CATALOGUE.

Kahn System of Reinforced Concrete

Can be used in Bridges, Arches, Foundations, Walls, Floors, Roofs and in all Reinforced Concrete Construction,
The U. S. Government has adopted the Kahn System in the 3 military barracks buildings now being erected at Washington, D. C.

Perspective View of Sheared Bar.



¾x1¼-in. (1.4-lb.) ¾x2 3/16-in. (2.7-lb.) **1x3-in. (4.8-lb.)** 1¼x3¾-in. (6.9-lb.)

STANDARD SECTIONS.

Standard lengths of diagonal, 6-in., 8-in., 12-in. and 18-in. Bar lengths to order.

These sections are rolled and kept in stock for immediate delivery.

TRUSSED CONCRETE STEEL CO.

1183 Union Trust Bldg., DETROIT, MICH.

There is But One Niagara

There is more power in Niagara Falls than any other water on earth.

Four great inland seas pour their water over this mighty cataract.

There is but one road running directly by and in full view of the entire panorama of the falls. It is the

Michigan Central, "The Niagara Falls Route," between Chicago, Detroit, Buffalo, New York and Boston. Send 3 red stamps for Niagara booklet and ask about new Niagara picture.

O. W. Ruggles, G. P. & T. A., Chicago

1744 Market Street Philada. Shannon & Co.

CONTRACTORS' EQUIPMENT RAILROAD SUPPLIES

1744 Market Street Philada. Shannon & Co.

EVERYTHING FOR CONTRACTORS

Agents for BALDWIN LOCOMOTIVES.

MAKERS OF

DERRICKS AND DERRICK FITTINGS

DEALERS IN

RAILWAY SUPPLIES, STEAM SHOVELS
CENTRIFUGAL PUMPS, BOILERS
DUMP CARS, ETC.

AGENTS FOR

Mundy Hoisting Engines, Baldwin Locomotives
Roebling's Wire Rope
Stuebner Dumping Buckets
Dunn Sewer Braces, Emerson Vacuum Pumps
Marsh Steam Pumps
Brown Hoisting Machinery Co.'s
Locomotive Cranes

PRICES ALWAYS RIGHT

1744 Market Street Philada. Hardware Shannon & Co.

J. JACOB SHANNON & CO.

1744 MARKET STREET PHILADELPHIA 1744

1744 Market Street Philada. Hardware Shannon & Co.

The Stubbs New Patent Wheeled Scraper

CONSTRUCTED ON CORRECT MECHANICAL LINES

Patented Sept. 4, 1900.

Adapted to all Kinds of Work — Saves One Man on the Dump

CLAIMS

Loads Easiest In loading the scraper is drawn by the lower hook and as the pull is from the mouth of the pan it loads easier than any other scraper.

Carries Safely When loaded the pan is held by the upper hook which prevents loss of load in transit and liability to accident.

Self-Dumping The draft irons are connected at a point above and behind the axle and by detaching the safety hooks by the use of a lever, the team which is pulling from the top of a load, pulls it over, thereby saving one man on the dump.

Sand Collars All wheels filled with our new patent sand collars—one that DOES KEEP OUT SAND.

No Sore Necks The construction of our scraper is such that the pole has a steady forward movement and does not throw down on the necks and shoulders.

Levee Work One man can operate our scraper, dump and scraper going up hill.

The Mechanical Manufacturing Company

Write for Prices CHICAGO *AGENTS WANTED*

EDSON MFG. CO. — 60 DAYS TRIAL OFFER — SEND FOR CATALOG — OUTLESS EXCAVATING OUTFITS — CONTRACTORS TRENCH PUMPS AND HOSE — FULL CATALOG FREE — HYDRAULIC PILE SINKING OUTFITS — EDSON INVENTIONS LABOR SAVERS — 257 ATLANTIC AVE. BOSTON MASS. — EST. 1859

P. H. & J. Conlan

Telephone, 7822 Newark — 253 Lafayette Street NEWARK, N. J.

ARTESIAN WELLS

Contractors for Drilling

Water, Oil or Gas Wells

TO

5,000 FEET

THE ROYAL FAMILY OF Scrapers and Plows

SEND FOR CATALOGUE

Royal Wheeled Scrapers

In three sizes. Capacity, 9, 12 and 16 cubic feet.

THE ONLY One-Man Wheeler

and the only Wheeler upon which the driver rides and fills and dumps it with ease. More work can be done in one day with five of these scrapers than with seven of any other make and with less men per scraper. This should be of interest to every contractor.

Royal Drag Scrapers

In three sizes, 4½, 5½ and 7 cu. ft. Best scraper made.

ROYAL Township and Railroad Plows

In different sizes and made especially for this class of work.

SMITH & SONS MFG. Co., Kansas City, Mo.

A. J. MORSE & SON. DIVING APPARATUS 140 CONGRESS ST. BOSTON.

Established 1844 **A. SCHRADER'S SON**

82 Rose Street, New York

Manufacturer of

Diving Apparatus

Complete Stock of Dresses, Hose and Repair Sundries. All orders filled day received.

Improved Bolt Helmet WRITE FOR OUR PRICES

COLE BROS., 102 Fulton St., N.Y.

CONTRACTORS FOR

Artesian Wells and Water Supply

Wells sunk in earth or rock, any depth.

Test borings for water or foundations

In Writing to Advertisers Please Mention ENGINEERING NEWS.

AUSTIN MFG. CO.

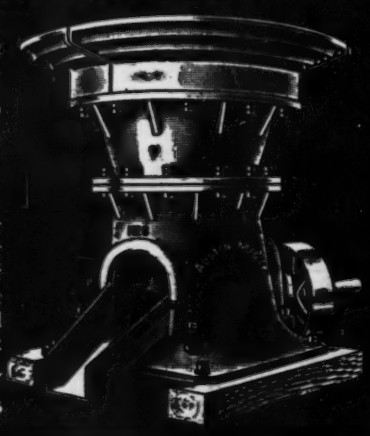
Chicago, Ill., U. S. A. NEW YORK OFFICE: PARK ROW BUILDING

BUILDERS OF

Complete Rock and Ore Crushing Plants, Revolving Screens, Elevators, Dump Cars, Etc. : : :

Compared with others THE AUSTIN is more durable, has greater capacity per horse power, easier adjustments, stronger parts, is of more scientific design and is the only automatically lubricated crusher on the market. : :

Austin Gyratory Rock and Ore Crushers



Discriminating mine engineers invariably admit that the

Austin Gyratory Crushers

embody improvements which overcome the faults in other crushers that have aggravated mine owners and operators for years. .. ..

Capacities ranging from 40 to 2000 tons daily

BUILT in NINE SIZES

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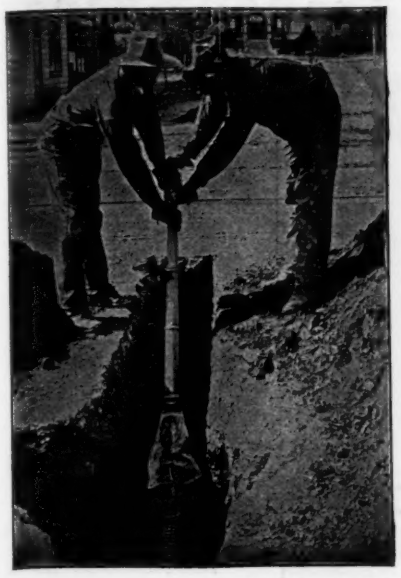

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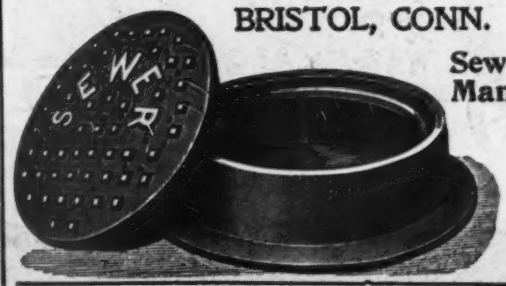

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(Used by U. S. and Foreign Govts.)
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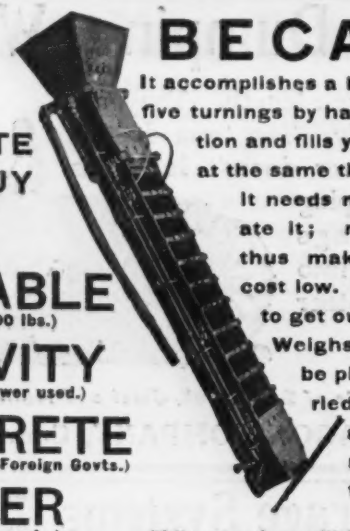

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See our advertisement in last issue of this paper.

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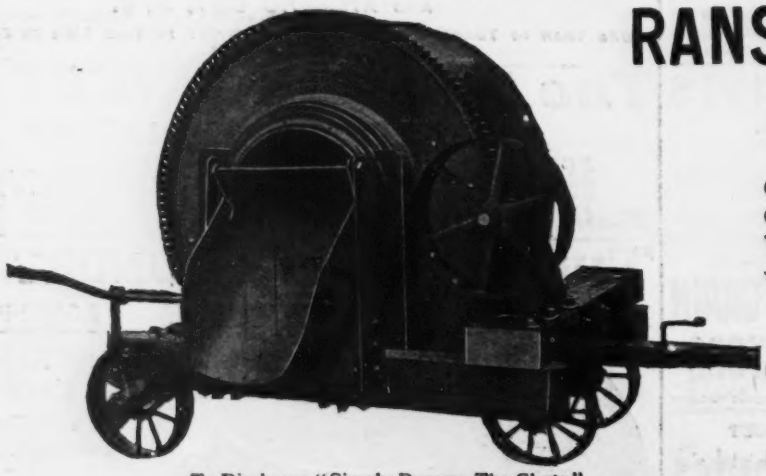

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All Sizes 3 to 12 Tons

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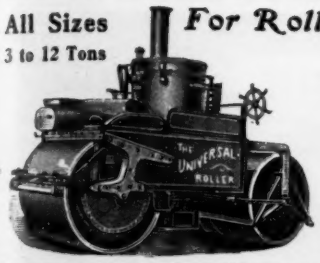

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furnish the same *accurate pitch, true rims, perfect form of teeth, approved proportions*, and, in addition, have the protection of the *hard scale surface* of the casting for wear, while *cut gearing* presents a soft porous surface.

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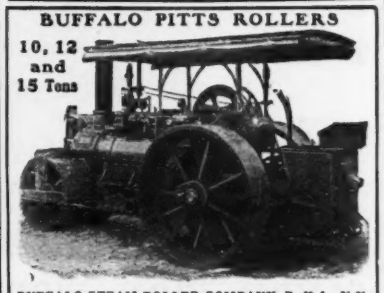

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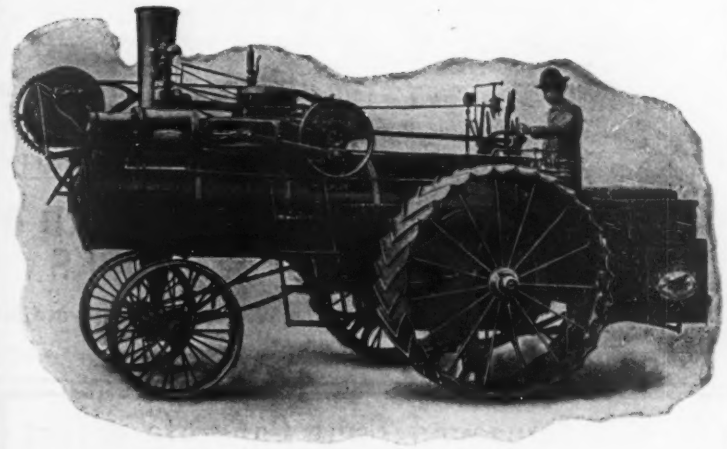

Our engine has more kinds of usefulness than any other traction engine made. It is **The Only General Purpose Engine** because it is the only engine designed for all the purposes and having all the attachments required by the engineer or contractor.

Cut shows engine equipped with hoisting drum.

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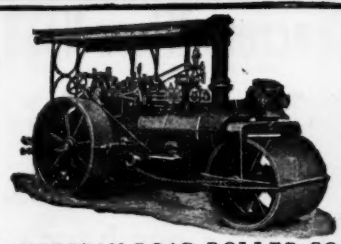

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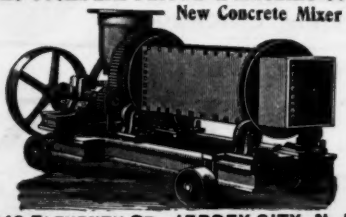

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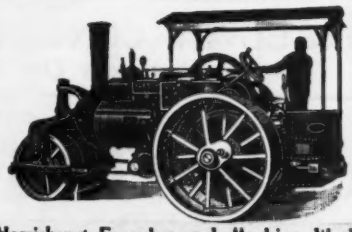

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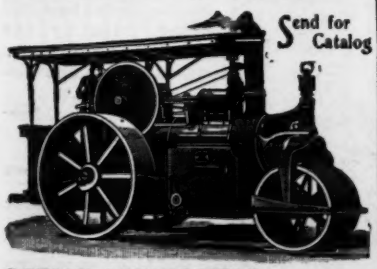

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For fastening all kinds of structure to brick and stone work

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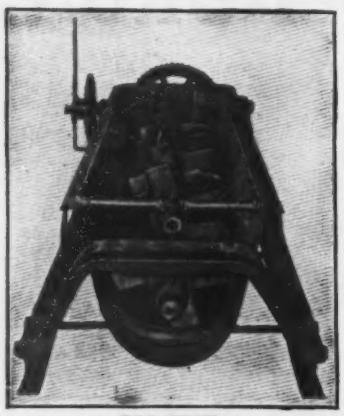

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We Build 30 Sizes and Styles of Mixers.

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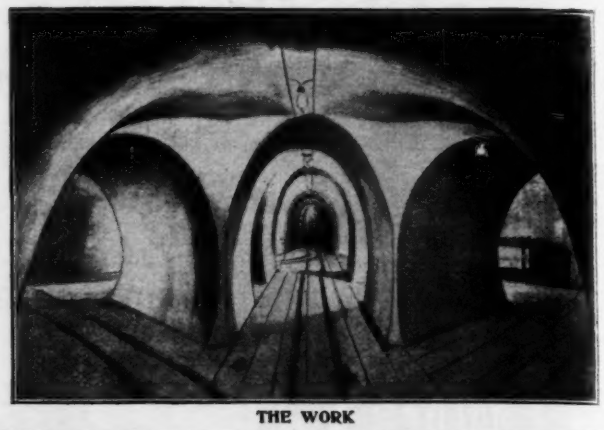

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Chicago Improved Cube Concrete Mixers

No. 3 Portable, Capacity One-half yard Batch

Endorsed by the Leading Engineers

The Most Rapid—the Most Uniform Production

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SOMETHING NEW

MACHINE IS BALL BEARING; REQUIRES SMALL AMOUNT OF POWER

The Simplest Concrete Mixer Ever Invented. The Mixture Always in Sight.

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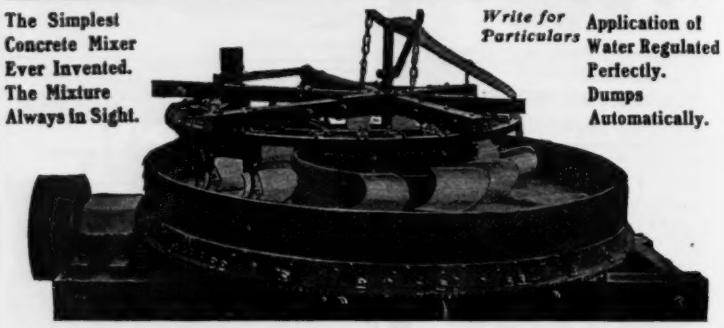
Application of Water Regulated Perfectly. Dumps Automatically.



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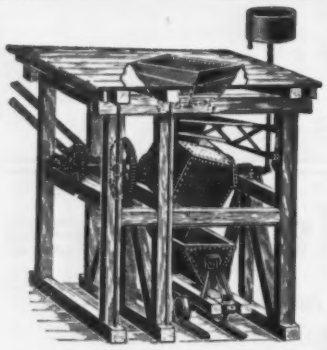

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Also Complete Line of Continuous

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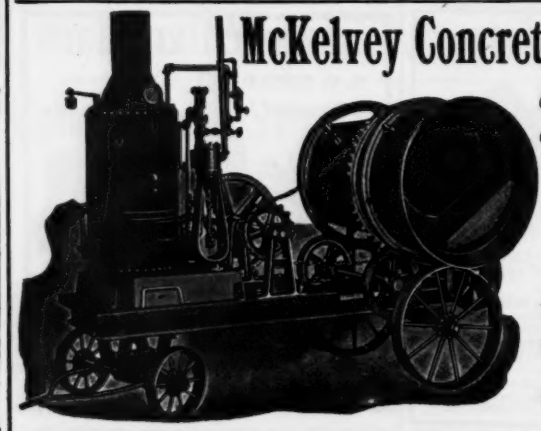

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Will Pay for Itself in 30 Days

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Containing the History and Descriptions of the Source and Mode of Supply, Pumps, Reservoirs, Stand-Pipes, Distribution Systems, Pressures, Consumption, Revenue and Expenses, Cost, Debt and Sinking Fund, and Officials of the Water-Works of the United States and Canada.

By M. N. BAKER, Associate Editor "Engineering News."

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Sample pages and Table of Contents on request.

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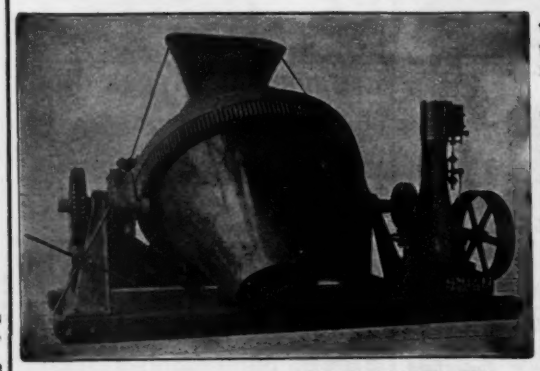
The SMITH MIXER



will save three-fourths of the labor cost of hand mixing?

At the same time the concrete made by **The Smith Mixer** will be far better than the same material hand mixed.

With a Smith Mixer you get two results:

1. Your Work is the Best.
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Why not investigate? We will help you to do so.

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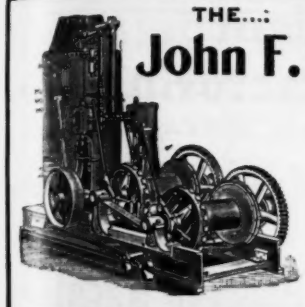

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Hoisting Engines
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Our new Tubs for Trench Work have advantages that should interest every contractor.

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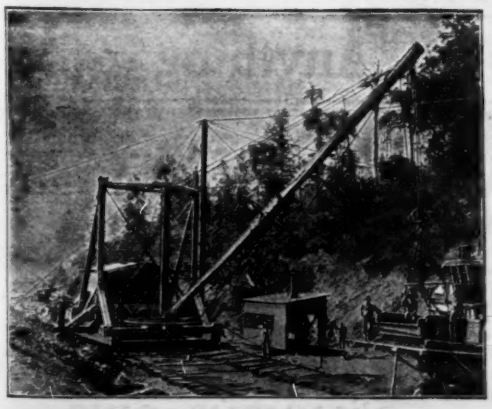

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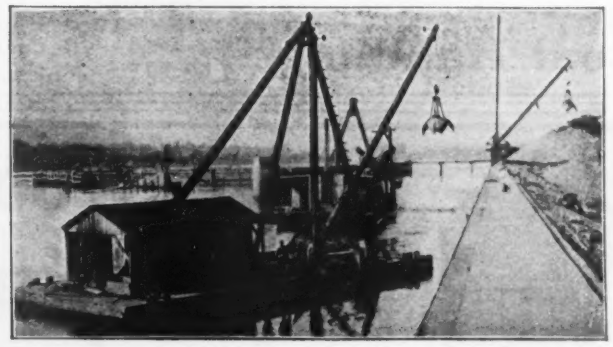

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FIRST cost with us is usually **HIGH.**

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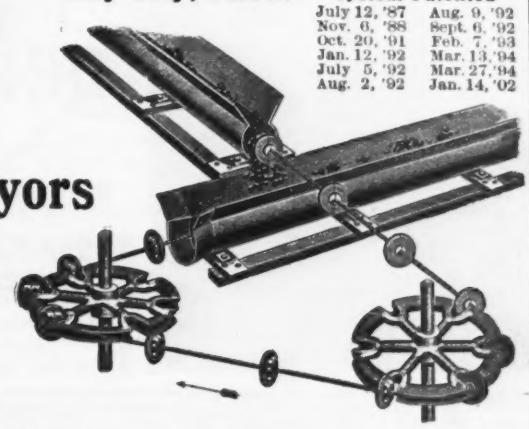

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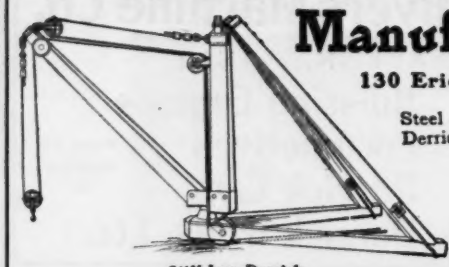

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Steel or Wood Derricks Complete.
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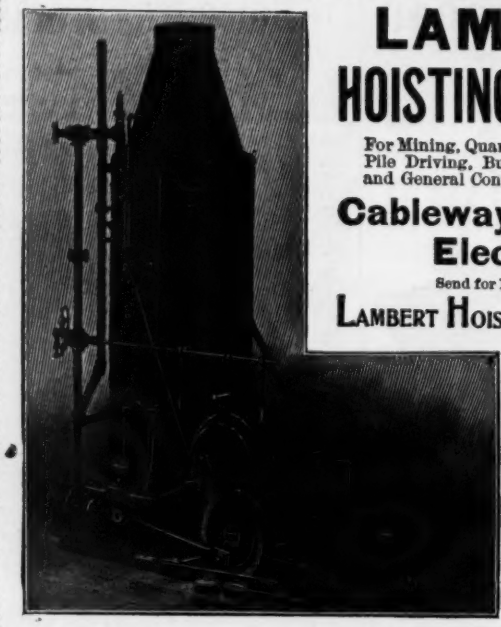
Hoisting Machines



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Write for Catalogue 705-A.

Will handle merchandise over any irregular area, and are most economically installed. We also make Traveling and Gantry Cranes.

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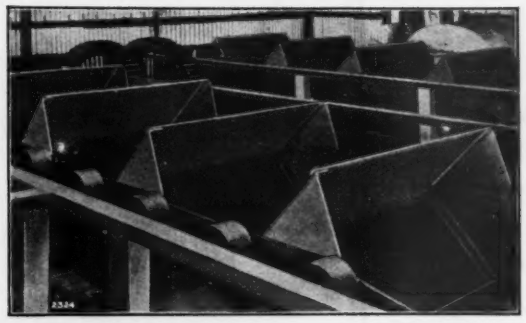

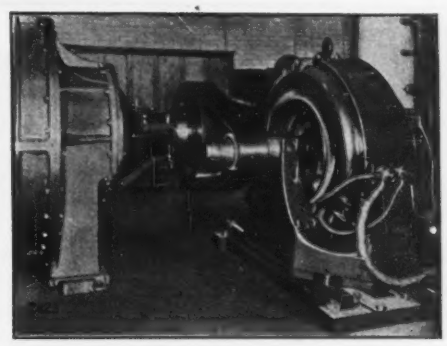

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"Our guarantees are never based upon hope, but upon honest determination."

We have recently completed the designing and installation of an extensive coal-handling plant for the Maryland Steel Co. at Sparrow's Point, Md. The illustration shows the overhead horizontal runs of the gravity discharge elevators, which deliver to chute leading to belt conveyer.

Write for full particulars regarding this and other coal handling plants designed by us.

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This is not leather belting, but a ninety horse-power Silent Chain driving a blower at R. H. Macy & Co.'s Store, New York City. In this drive, to relieve the chain of any sudden jerk, we employ the spring center; the result is shown in the cut. Motor running full speed,—note smooth running. Write for Silent Chain Booklet "D."

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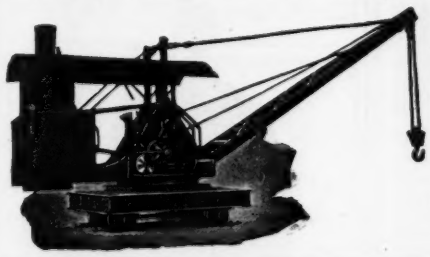

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Capacities, 3 to 30 tons

WITH OR WITHOUT

Clam Shell or Orange Peel BUCKETS

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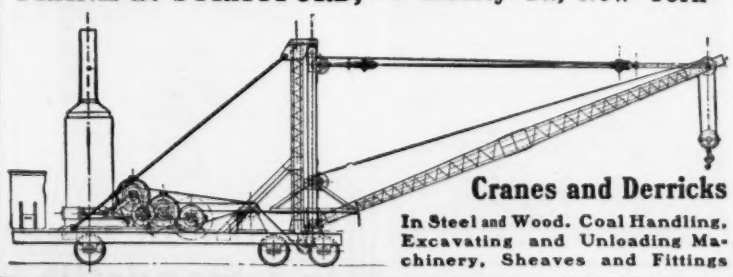

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In Steel and Wood. Coal Handling, Excavating and Unloading Machinery, Sheaves and Fittings

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21⅄ INCHES (540 m/m) STANDARD GAUGE

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For Factories, Engineering Works, Lumber Mills and Boiler Rooms, etc.

To responsible parties having use for a system of narrow gage tracks for handling materials, we will send a layout of track, switches, curves and standard cars, that can be laid down, and put into actual service.

We would expect the recipient to pay the freight on the material and to put the cars into regular service. At the end of a month the material is to be returned to us, we paying the return freight charges, or the material can be retained and paid for.

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Built to any specifications. Standard capacity, 1,000 to 10,000 lbs. Particularly adaptable for handling heavy materials in loading or unloading Freight Cars, Boats, or for Coaling Locomotives. Mounted on car with standard track gage.

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MACHINE AND STRUCTURAL IRON WORK.

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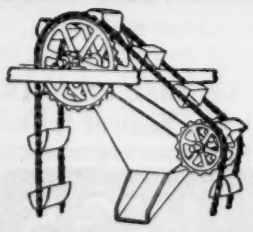

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Chains (all styles), Sprocket Wheels, Spiral Conveyors, Elevator Buckets, Boots, Bolts, Screens, Coal and Coke Crushers, Dump Cars, Skip Cars, Grain Dryers, Columbian Separator, Coal and Ashes Handling Machinery, Dredges, Coal Washing Machinery, Coal Mining Machinery, Electric Mine Locomotives, Power Transmission Machinery, etc.

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Coal and ash handling equipments are important among our labor saving installations.

Any information, designs or estimates are free of cost to you. Our catalog for the asking.

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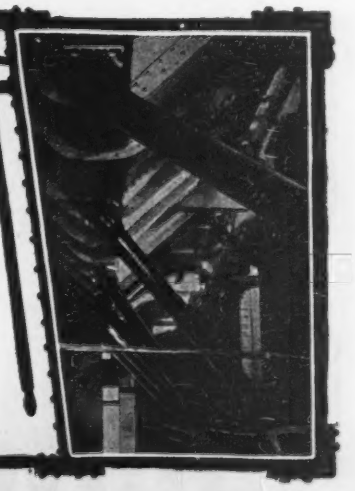

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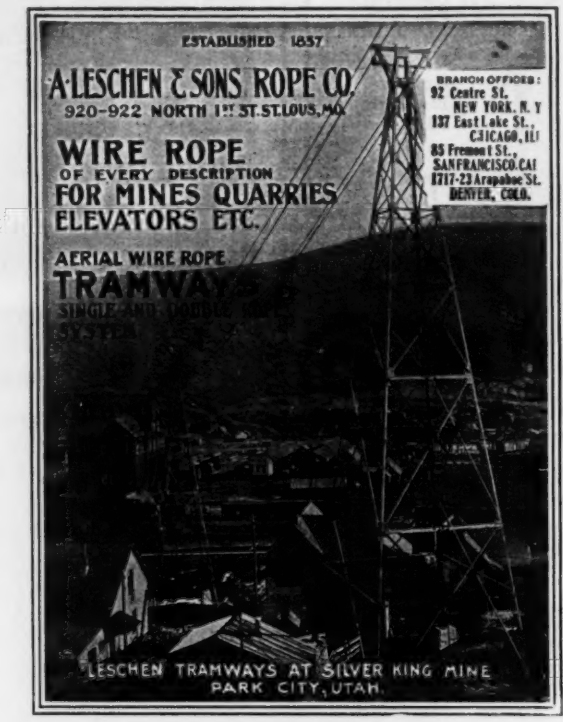
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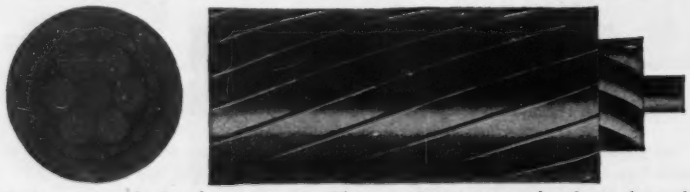
OF EVERY DESCRIPTION
FOR MINES QUARRIES ELEVATORS ETC.
AERIAL WIRE ROPE
TRAMWAYS
LESCHEN TRAMWAYS AT SILVER KING MINE
PARK CITY, UTAH.

See those wires—how they interlock? Note the smooth surface also.



No displacements of wires in any event. Gives much greater service than other cables, and adds correspondingly to the life of the rolling stock.

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LOCKED-COIL TRACK CABLE

used only on the Patent

BLEICHERT WIRE ROPE TRAMWAY,

SUPERIOR TO ALL OTHER SYSTEMS.

Manufactured by **THE TRENTON IRON CO.** Trenton, N.J.

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Robins Conveying Belt Company

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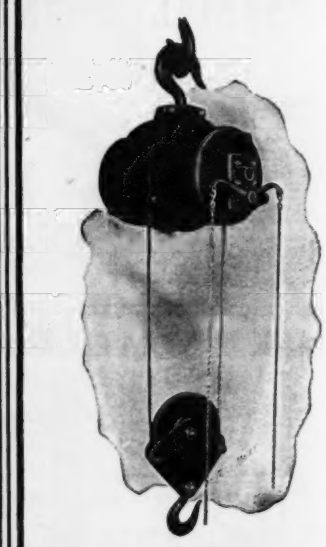

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and all gradations of speed between, in an instant with the

SHEPARD HOIST

The load is always under ABSOLUTE CONTROL

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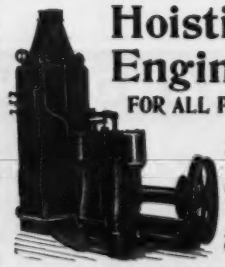
FOR ALL PURPOSES



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CRANES for any Service

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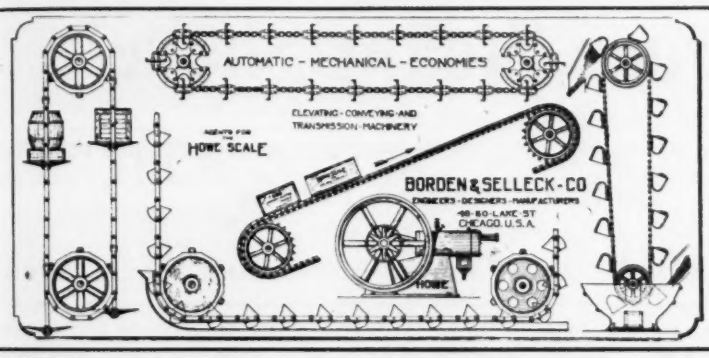
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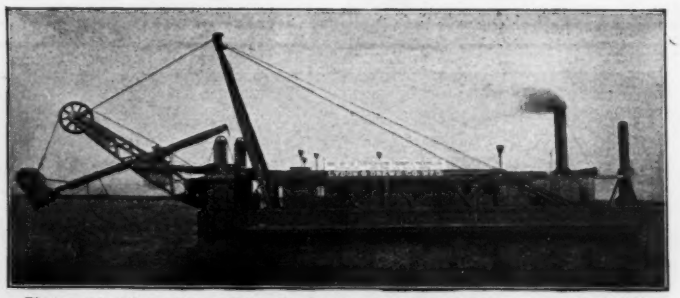
Dredge Machinery

Corliss Engines *Ice Machines*



Photograph of largest Fresh Water Dredge, described in Engineering News, Feb. 28, 1901.

Featherstone Foundry & Machine Co.

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Chicago, Ill. U. S. A.

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Cable and Automatic Railways *Ash and Coal Cars*

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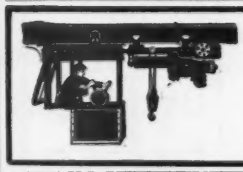
FOR ALL PURPOSES

Hydraulic Dredging Machinery

Correspondence Solicited ELLICOTT MACHINE COMPANY, Baltimore, Maryland



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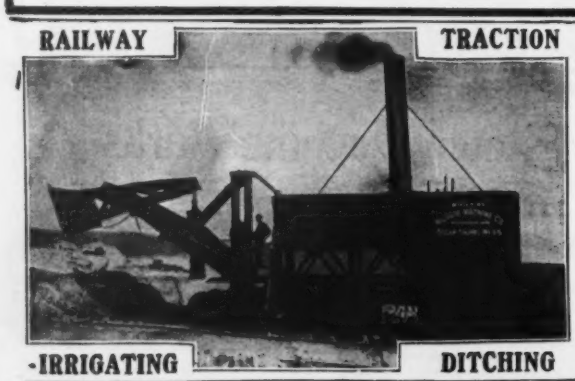

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Quick-Acting, Direct Connected, No Chains or Cables!

Kilgore Steam Shovel

Practically all the machinery in front of car body.
Few working parts to require repairs.

Built for Hardest Service

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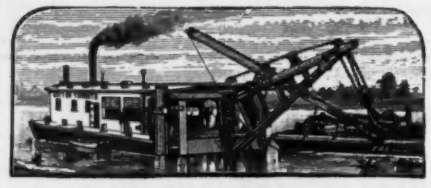

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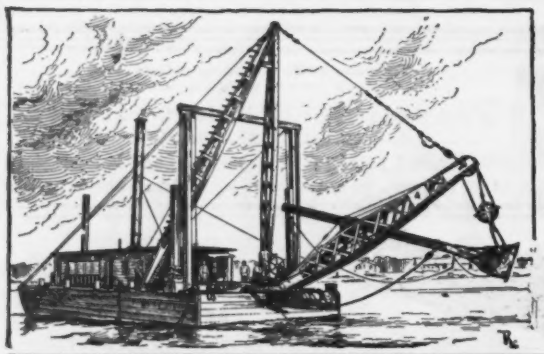

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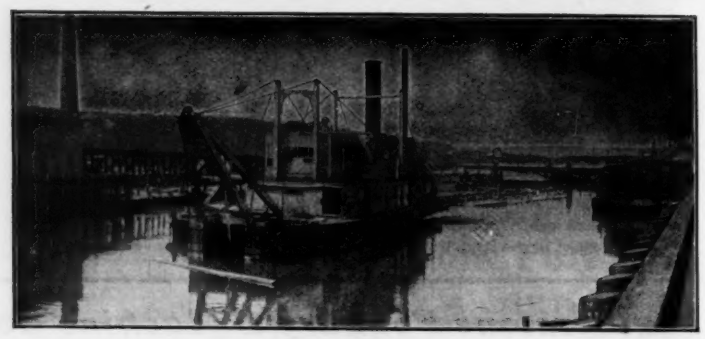

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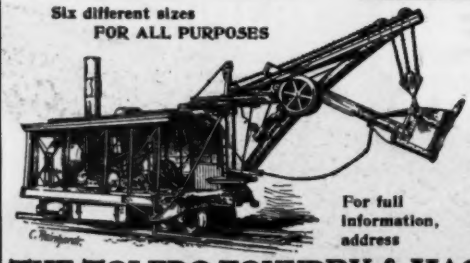

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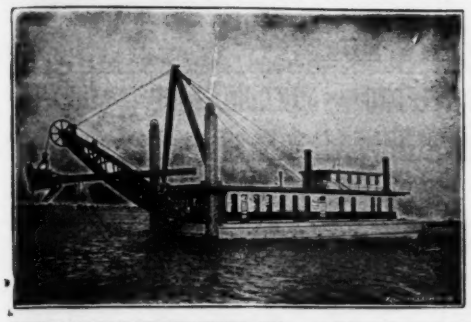

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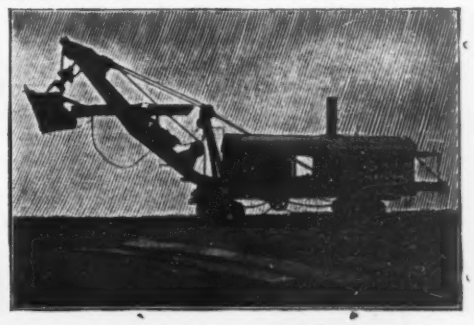

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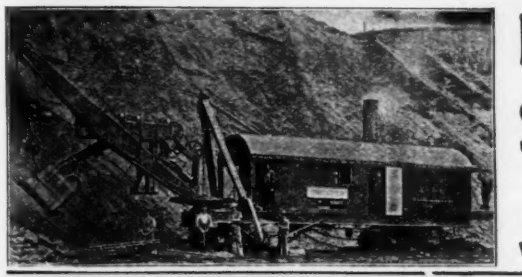

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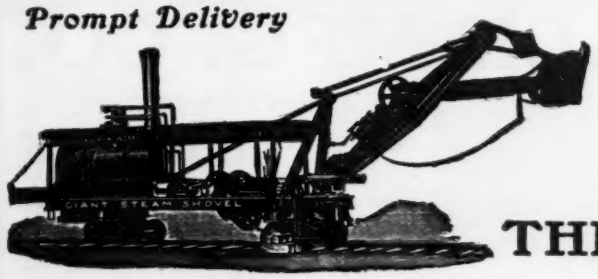

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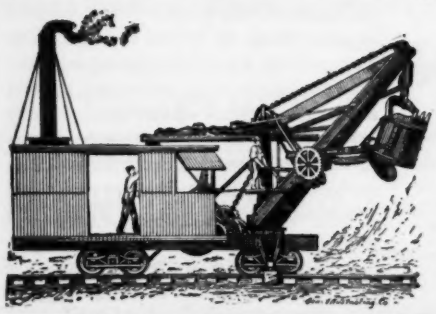

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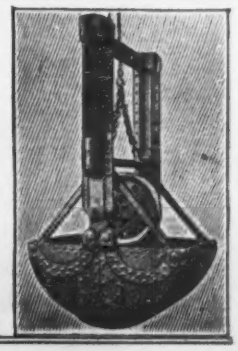

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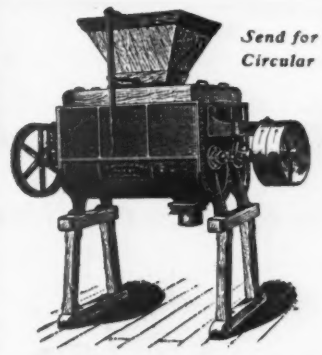
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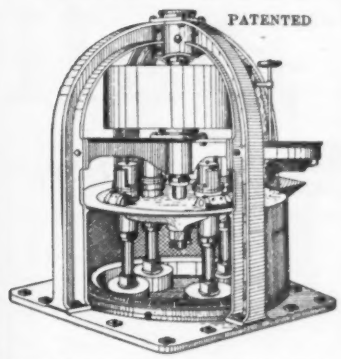
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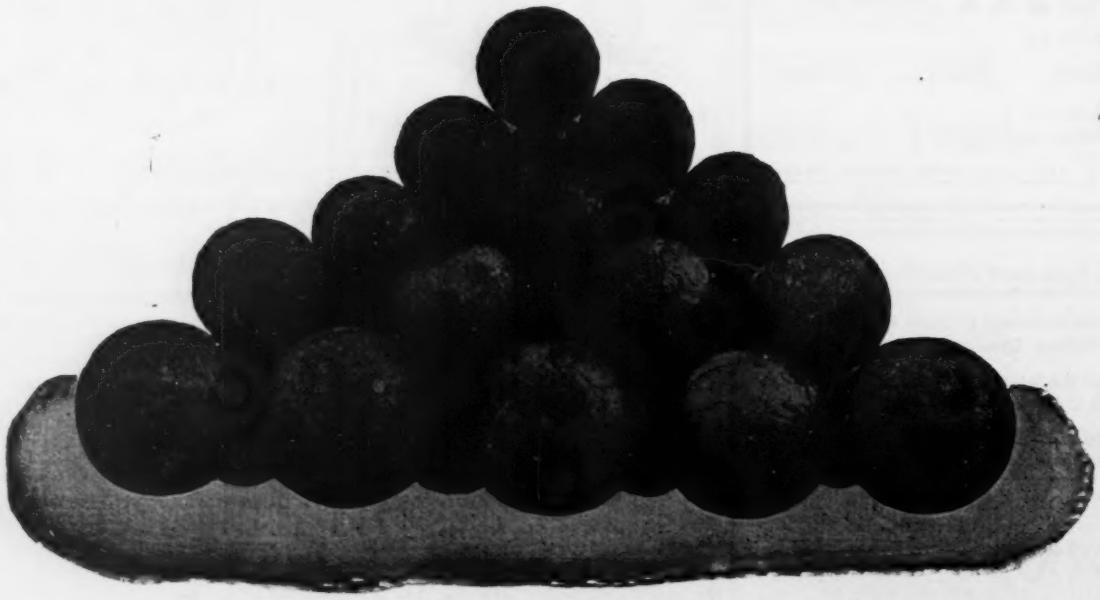

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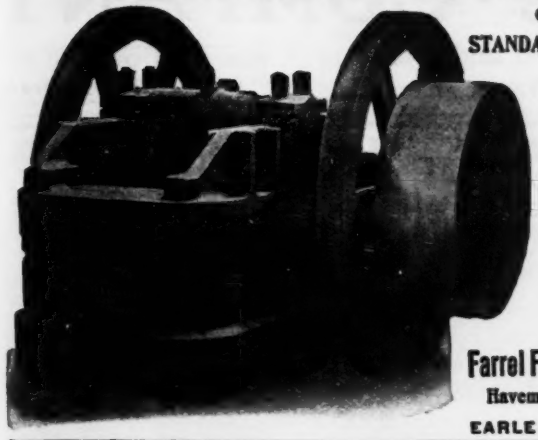

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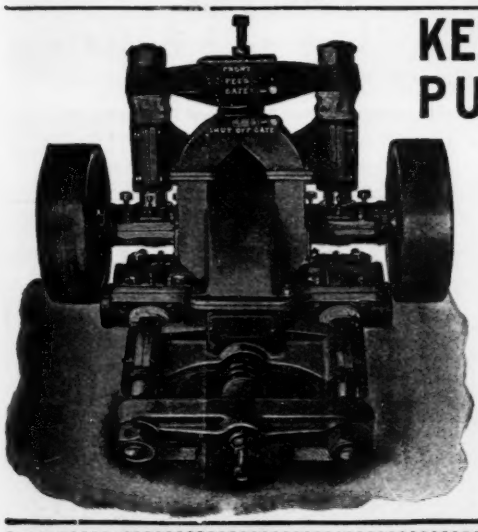

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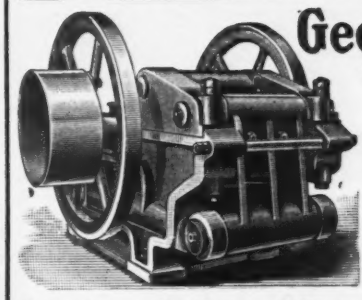

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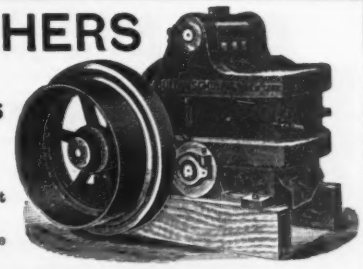

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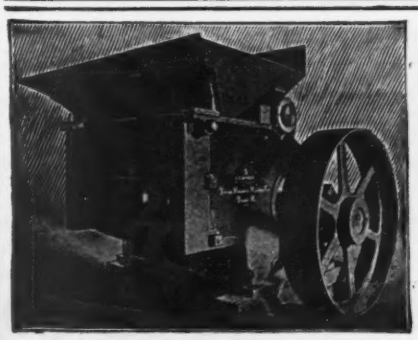

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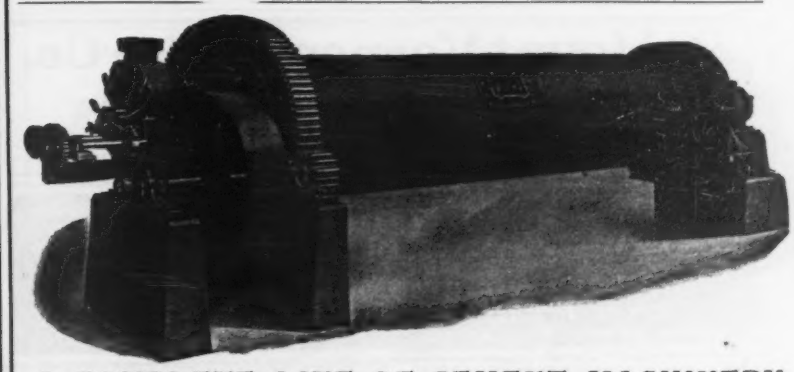

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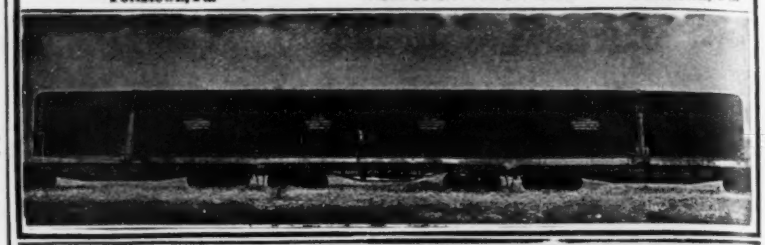

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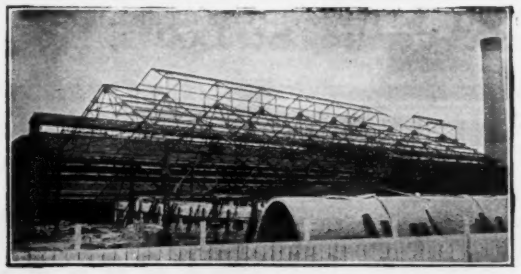

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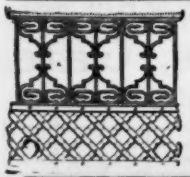

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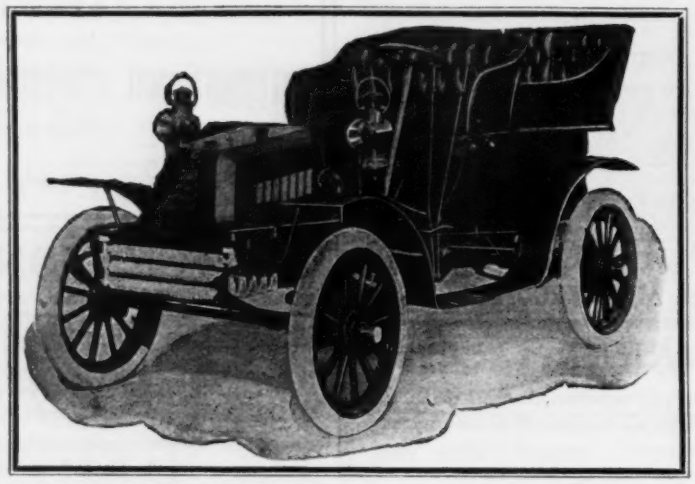

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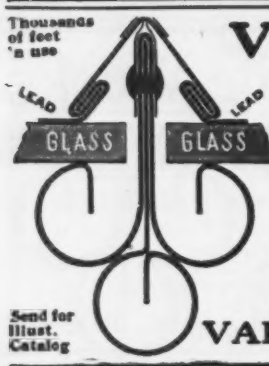

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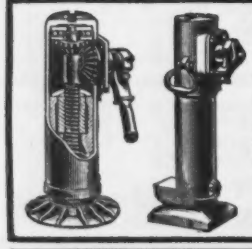

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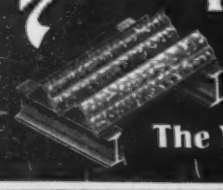

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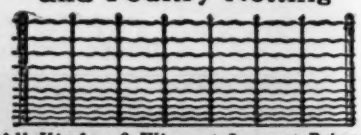

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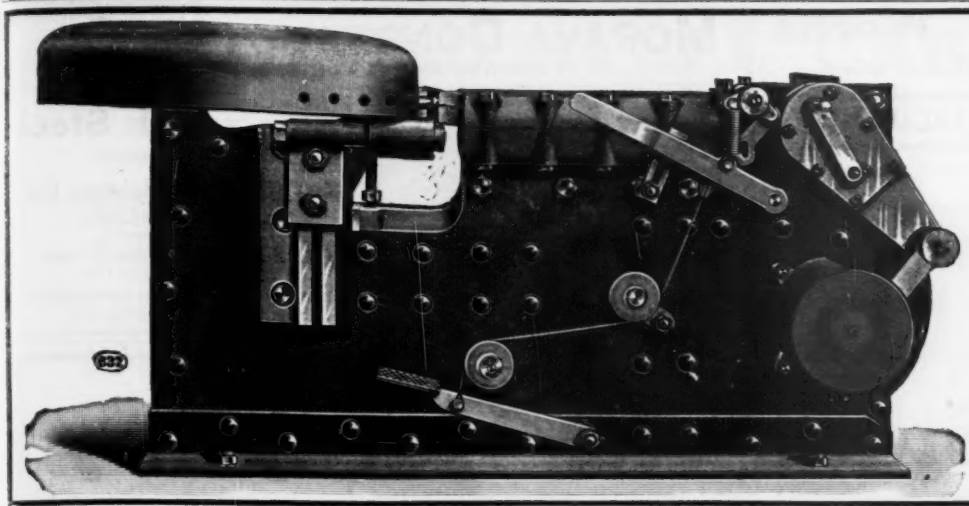

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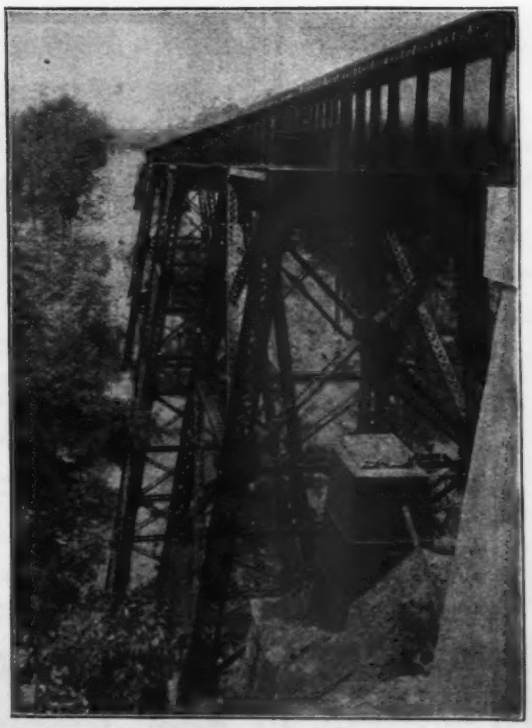

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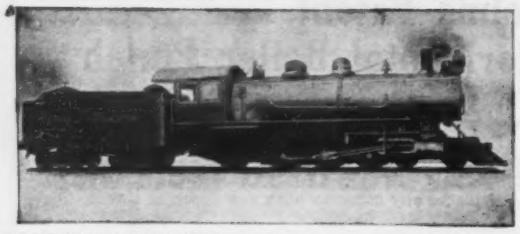

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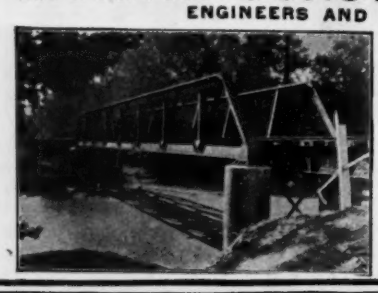

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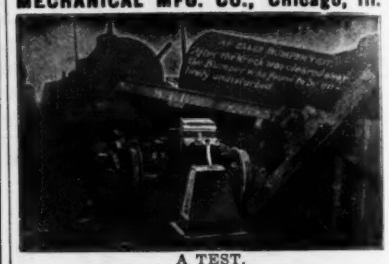

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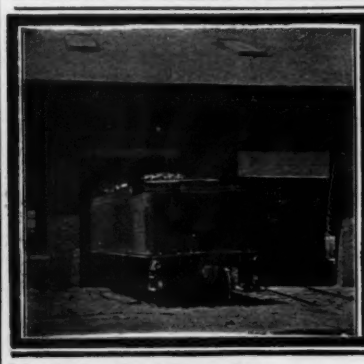

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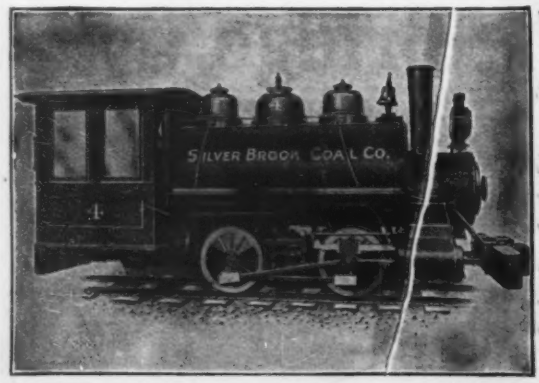

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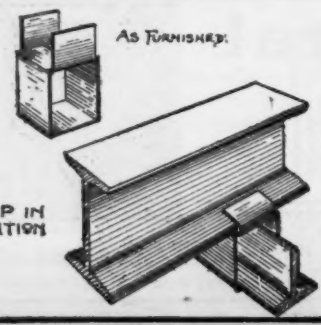

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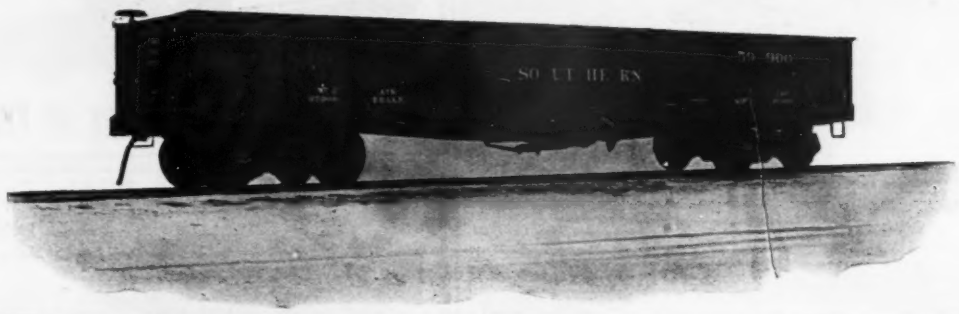

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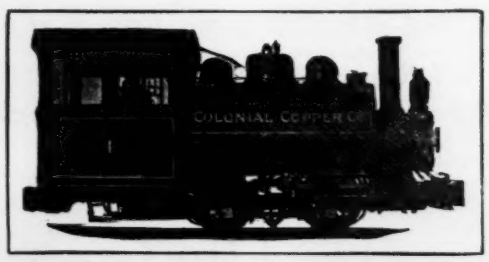

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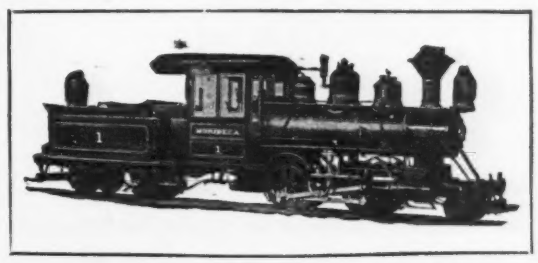

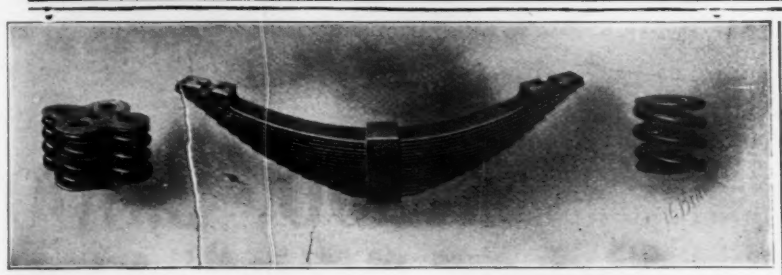

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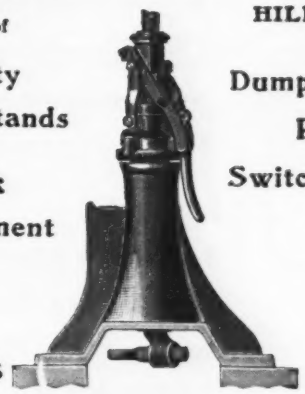

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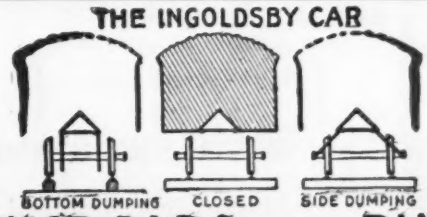

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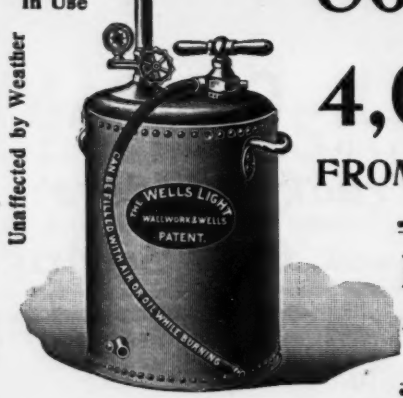

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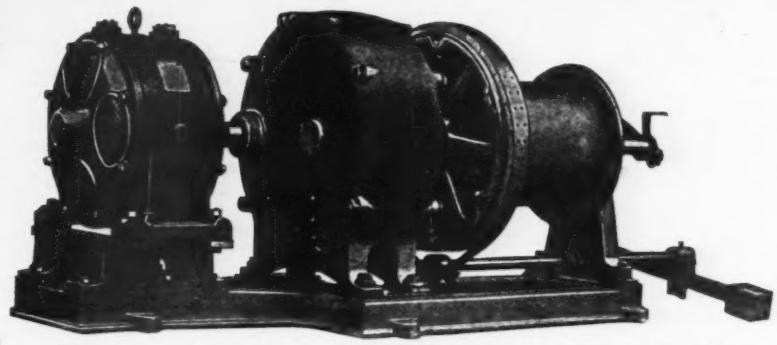

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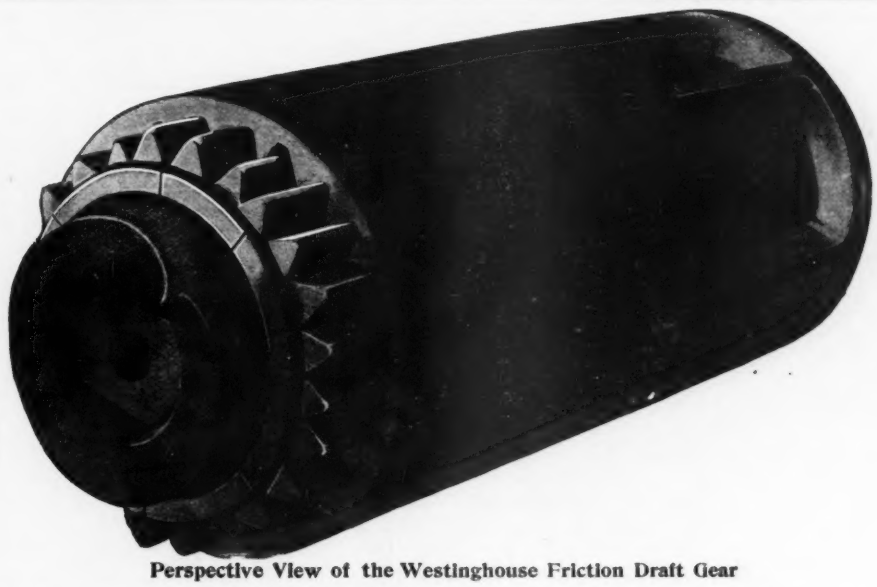

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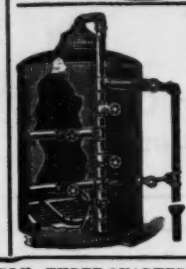

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